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Volume 8 Number 2 / January 23, 1970

TABLE OF CONTENTS

Subject Categories

Abstracts in the journal are grouped under the following categories:

page:

01 AERODYNAMICS
Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion. **20**

02 AIRCRAFT
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **207**

03 AUXILIARY SYSTEMS
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. **211**

04 BIOSCIENCES
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. **216**

05 BIOTECHNOLOGY
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences. **221**

06 CHEMISTRY
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. **225**

07 COMMUNICATIONS
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. **237**

08 COMPUTERS
Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics. **245**

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation. **254**

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories. **262**

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations. **263**

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion. **265**

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences. **272**

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras. **282**

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection. **288**

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State. **292**

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see : 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics. **294**

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics. **301**

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers. **307**

20 METEOROLOGY
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences. 317

21 NAVIGATION
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications. 321

22 NUCLEAR ENGINEERING
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems. 323

23 PHYSICS, GENERAL
Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation. 331

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation. 337

25 PHYSICS, PLASMA
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems. 357

26 PHYSICS, SOLID-STATE
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics. 361

27 PROPELLANTS
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems. 364

28 PROPULSION SYSTEMS
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants. 364

29 SPACE RADIATION
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear. 366

30 SPACE SCIENCES
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles. 368

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics. **374**

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic. **376**

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants. **381**

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents. **385**

SUBJECT INDEX I-1

PERSONAL AUTHOR INDEX I-71

CORPORATE SOURCE INDEX I-101

CONTRACT NUMBER INDEX I-119

REPORT/ACCESSION NUMBER INDEX I-125

ACCESSION/REPORT NUMBER INDEX I-139

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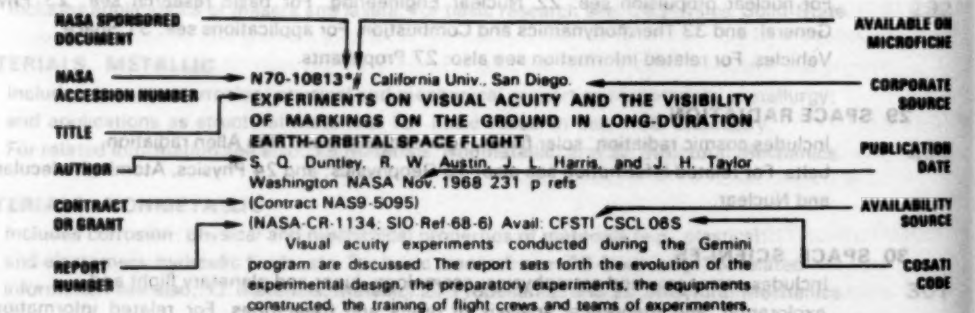
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EXPERIMENTS ON VISUAL ACUITY AND THE VISIBILITY OF MARKINGS ON THE GROUND IN LONG-DURATION EARTH-ORBITAL SPACE FLIGHT
AUTHOR
S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
PUBLICATION DATE
Washington NASA Nov. 1968 231 p refs
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(Contract NAS9-5095)
AVAILABILITY SOURCE
REPORT NUMBER
(NASA-CR-1134; SIO-Ref-68-6) Avail: CFSTI CSCL 06S
COSATI CODE
Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space
Author

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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N70-11504*# Techtran Corp., Glen Burnie, Md.
EFFECT OF THE AIR INTAKE OF A LIFTING ENGINE ON THE AERODYNAMIC CHARACTERISTICS OF A WING [VLIYANIYE VOZDUKHOZABORNIKA PODYEMNOGO DVIGATELIYA NA AERODINAMICHESKIYE KHARAKTERISTIKI KRYLA]
V. N. Arnoldov et al Washington NASA Nov. 1969 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 3, 1969 p 185–189
(Contract NASw-1695)
(NASA-TT-F-12708) Avail: CFSTI CSCL 01A

Analysis of the aerodynamic forces and moments developing in aircraft as a result of the air intake operation is presented. Wind tunnel experiments on a circular wing model with a hole in its center simulating the air intake of a lifting engine were conducted. It is found that the fraction of the total boost of a lifting engine which is applied to the outer air intake surface is distributed over a small area near the air intake inlet and increases substantially as the rate of the incident airflow increases. Also, an additional moment and drag, increasing with the incident airflow velocity, are found to develop in the wing, due to the air intake operation.
Author

N70-11515 Army Foreign Science and Technology Center, Washington, D.C.
THE EFFECT OF CERTAIN PARAMETERS ON THE VARIABLE AERODYNAMIC FORCES ACTING ON A TURBINE STAGE
A. S. Laskin et al 1969 15 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Energ. (Minsk), v. 11, no. 5, 1968 p 114–118
(AD-693063; FSTC-HT-23-246-69) Avail: CFSTI CSCL 13/7

The interconnection between the intensity of the irregularity caused by border traces behind the control apparatus and the quantity of variable aerodynamic loads on the working vanes was determined experimentally.
Author (TAB)

N70-11541# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF NONUNIFORMITY OF INCIDENT FLOW ON THE CHARACTERISTICS OF THE STAGES OF A COMPRESSOR WITH BLADES WITH A SMALL ASPECT RATIO
A. E. Polyakov 30 Jan. 1969 8 p refs Transl. into ENGLISH from Samoletostroeniya i Tekhn. Vozdushnogo Flota, no. 9, 1967 p 22–24
(AD-693656; FTD-HT-23-782-68) Avail: CFSTI CSCL 13/7

The experimental results are presented of a study of the effect of nonuniformity of the velocity field on compressor rotor and stage characteristics. The experiments were performed on a single-stage compressor with an external diameter ratio and a rotor hub-tip ratio, with a peripheral blade tip velocity of U equals 153 m/sec. The Reynolds number was approximately 3.5.10(superscript 5). The main tests were conducted on blades. The nonuniformity of the velocity fields was produced by reducing the flow velocity with concentric rings made of 0.6 mm wire, mounted at the hub and near the inlet periphery cross-section. Velocity diagrams used in determining stage characteristics are shown. An increase in the flow nonuniformity at the periphery results in a substantial reduction of the efficiency and pressure of the investigated rotor. If the nonuniformity extends along the blade height, the rotor characteristics deteriorate.
Author (TAB)

N70-11802# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE STARTING OF SUPERSONIC NOZZLES WITH THE AID OF CYLINDRICAL DIFFUSERS
V. F. Davidson 18 Jun. 1969 5 p Transl. into ENGLISH from Gidroaeromekhanika (Russian), no. 7, 1968 p 33–36
(AD-693611; FTD-HT-23-142-69) Avail: CFSTI CSCL 14/2

The efficiency of short cylindric diffusers was experimentally investigated in a supersonic wind tunnel provided with exchangeable nozzles with a conical supersonic section designed for M equals 2; 2.5; 3.0; 3.5; 4.0; and 5.0 and a half cone angle of alpha equals 8 degrees for all M numbers. The diffusor lengths varied from one to eight calibers of the nozzle exit cross sections. Compressed nitrogen was used as the working substance. A graph of the ratio of the aerodynamic stagnation pressure during startup of a nozzle with diffusers to the relative diffuser length showed the advantage of using diffusers at higher nozzle M values. A diffuser length of up to 3-4 nozzle calibers practically exhausts the possibility of decreasing the starting pressure of nozzles with calculated M values of less than 3. Diffuser lengths up to 6-7 calibers are expedient on nozzles for nearly hypersonic M values. Sufficiently long cylindrical diffusers have an efficiency of 0.75-0.85. Diagrams are presented for selecting minimum diffuser lengths in the range of M equals 2-5. The experiments revealed that the maximum rarefaction attainable with cylindrical diffusers at the nozzle exit section during discharge into a normal atmosphere is 0.04 atm.
Author (TAB)

N70-11829*# Lockheed-Georgia Co., Marietta. Aerospace Research Lab.
THE AERODYNAMICS OF THE LIFTING JET IN A CROSS FLOWING STREAM
J. E. Hackett and H. R. Miller *In* NASA. Washington Analysis of a Jet in a Subsonic Crosswind 1969 p 37–48 refs (See N70-11826 02-02)
Avail: CFSTI CSCL 01A

The long-term aim of this work is to predict the path of the lifting jet plume with sufficient details of the flow structure to allow pressures to be calculated on nearby surfaces. Repeated was the calculation of the self-induced distortion of a two-dimensional circular cylinder immersed in a mainstream, with the aim of extending the work into a genuine three-dimensional approach, rather than using time analogue for jet direction. Flow visualization

studies on a wind tunnel model of lifting fan nacelle established the familiar vortex roll-up upstream of the intake and a flow structure was deduced and confirmed for very low Reynolds numbers. G.G.

N70-11830*# Georgia Inst. of Tech., Atlanta.
EXPERIMENTAL INVESTIGATION OF PRESSURES INDUCED ON A FLAT PLATE BY A JET ISSUING INTO A SUBSONIC CROSSWIND
Howard M. McMahon and David K. Mosher *In* NASA, Washington Analysis of a Jet in a Subsonic Crosswind 1969 p 49-62 refs (See N70-11826 02-02)
(Contract DAHC04-68-C0004)
Avail: CFSTI CSCL 01A

Measurements of static pressure distributions on a flat plate are presented for circular and non-circular jets issuing normal to the plate surface of various jet exit velocities. Certain trends concerning the pressure distribution patterns were noted. It was observed that the pattern for a given exit shape and jet velocity is similar to that for a smaller length-to-width ratio exit shape at a higher jet velocity. A check was made to see if this could be related to the jet plume path. The results indicate that the pressure distribution on the plate depends upon the character of the jet as well as upon the path of the jet plume relative to the plate. Author

N70-11831*# Army Missile Command, Redstone Arsenal, Ala. Advanced Systems Lab.
EXPERIMENTAL REACTION JET EFFECTS AT SUBSONIC SPEEDS
Troy A. Street and Donald J. Spring *In* NASA, Washington Analysis of a Jet in a Subsonic Crosswind 1969 p 63-84 refs (See N70-11826 02-02)
Avail: CFSTI CSCL 01A

Given is a very brief synopsis of the trends in the aerodynamic data accumulated experimentally in the subsonic regime. The data presented herein is a collection from a test of an axisymmetric body of revolution with a sonic jet injecting into a freestream Mach number of 0.285 and a sonic jet injecting from a flat plate into freestream Mach numbers of 0.1, 0.2, 0.4, and 0.6. Author

N70-11832*# Georgia Inst. of Tech., Atlanta.
A BLOCKAGE-SINK REPRESENTATION OF JET INTERFERENCE EFFECTS FOR NONCIRCULAR JET ORIFICES
J. C. Wu and M. A. Wright *In* NASA, Washington Analysis of a Jet in a Subsonic Crosswind 1969 p 85-99 refs (See N70-11826 02-02)
(Contract DAHC04-68-C0004)
Avail: CFSTI CSCL 01A

A study of the subsonic jet-in-crosswind problem is made by using a two-dimensional potential-flow representation of jet interference effects. Analyses are made for two different jet exit configurations: an ellipse with its major axis alined with the free stream flow direction, and an ellipse with its minor axis in the free-stream direction. In each of the configurations the jet issues normally from the surface of an infinite plate into the crosswind. The model uses a blockage-sink representation of the jet interference effects on the crosswind. The blockage element consists of a jet-exit-shaped cylinder with an attached afterbody and is used to simulate the effect of the jet-wake combination in displacing the crossflow. The sink element is placed in the afterbody to simulate the combined effect of entrainment by the jet as well as by the wake. Calculated pressure distributions on the plate are compared with experimental data obtained with similar jet exit configurations. The results show that the two-dimensional representation is useful for the case of high jet-to-crosswind speed ratio. Author

N70-11836*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTIC DESCRIPTION OF JET-WAKE CROSS SECTIONS FOR A JET NORMAL TO A SUBSONIC FREE STREAM
Richard J. Margason *In its* Analysis of a Jet in a Subsonic Crosswind 1969 p 131-139 refs (See N70-11826 02-02)
Avail: CFSTI CSCL 01A

An analytic description is given of jet-wake cross sections for a jet exiting normal to the free stream. The results indicate that a reasonable description can be obtained for the cross section. However, a complete description of the jet wake and associated phenomena requires a more complete model of the jet wake than that presented herein. Author

N70-11838*# Tennessee Univ., Knoxville. Space Inst.
CROSS WIND EFFECTS ON TRAJECTORY AND CROSS SECTIONS OF TURBULENT JETS
Gerhard W. Braun and Jack D. McAllister *In* NASA, Washington Analysis of a Jet in a Subsonic Crosswind 1969 p 141-164 refs (See N70-11826 02-02)
Avail: CFSTI CSCL 01A

Results in two loosely connected research areas concerning jets in cross flow are reported. An analysis of specific mass-momentum flux data showed that the entrained mass flux carries the undisturbed cross flow velocity into the jet in such a way that it adds momentum to the jet flow. This relation permits a calculation of the jet trajectory, when the mass entrainment is given, or a calculation of the entrainment, when the trajectory is known. If specific entrainment data are not known, the jet trajectory can be calculated by means of the assumption that the sidewise spreading rate of the jet and the nondimensionalized distribution of the excess velocity are the same as known from submerged jets. Measured trajectories are curve fitted by adjusting a free spreading rate parameter. The second part deals with the roll-up process of a jet in cross flow. Computer results obtained from potential flow calculations are shown for single and double jets with circular or elliptic exit nozzles. Author

N70-11841*# Florida Univ., Gainesville.
MASS ENTRAINMENT OF A CIRCULAR JET IN A CROSS FLOW
R. L. Fearn *In* NASA, Washington Analysis of a Jet in a Subsonic Crosswind 1969 p 239-247 refs (See N70-11826 02-02)
Avail: CFSTI CSCL 01A

By use of conservation of mass and momentum, an equation is derived relating the mass entrainment of a round turbulent jet exhausting into a cross flow to the equation for the jet axis. If an empirical equation for the jet axis is used, one finds that the mass entrainment approximates a linear dependence on distance along the jet axis. If, on the other hand, a linear entrainment of undetermined slope is assumed, a differential equation is obtained for the jet axis which can be solved analytically. Several members of the resulting family of one-parameter curves are fitted to empirically determined jet axes to obtain the entrainment as a function of the ratio of free-stream velocity to jet velocity. Author

N70-11905# Aeronautical Research Labs., Melbourne (Australia).
TRANSONIC WIND TUNNEL MEASUREMENTS OF THE INFLUENCE OF FIN SECTION PROFILE ON THE STATIC LONGITUDINAL STABILITY OF A LOW-DRAG BOMB
D. A. Secomb Oct. 1968 42 p refs
(ARL/A-307) Avail: CFSTI

The static longitudinal stability characteristics of a bomb comprising a low-drag body fitted with cruciform fins, and of the body alone, have been measured over the Mach number range 0.5 to 1.3 for angles of attack up to 10 deg. The effect of variation in fin section profile is emphasized, but some data on the effect of fin planform, Reynolds number variation, Reynolds number simulation and wall interference at low supersonic speeds are included. The basic fin section profile was an extended double wedge of maximum thickness/chord ratio of 3 per cent, with a parallel section extending from 30 to 90 per cent of chord. The leading and trailing edge radii were 0.15 per cent of chord. At subsonic speeds and low angles of attack, the arrangement with these fins was either unstable, or at best only marginally stable.

Modification of the section profile between the leading edge and 30 per cent of chord to resemble the RAE 101 section gave a stabilizing centre of pressure shift of about 0.2 maximum body diameters near sonic speed, but at other speeds the effect was slight. Modification of the section profile between 30 per cent of chord and the trailing edge to resemble the RAE 101 section gave a stabilizing centre of pressure shift of about 0.4 maximum body diameters over much of the subsonic speed range, but at near sonic speed the improvement was not maintained. Variation of the profile between the leading edge and 30 per cent of chord had no influence in this case. The limited measurements of the effect of fin planform suggest that these results apply equally for fins of the same exposed area and span but having leading edge sweep angles of either zero or 45 deg. Author

N70-12170# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

A PRELIMINARY EXPERIMENT IN RESONANCE TESTING A ROTATING BLADE

C. W. Skingle, D. R. Gaukroger, and G. A. Taylor Apr. 1969 18 p ref Supersedes RAE-TR-69067

(ARC-CP-1070; RAE-TR-69067) Avail: HMSO 4s 6d; BIS $0.90

An experiment to excite the flapping modes of a two-blade non-articulated model rotor is described. The experiment was designed to develop a method of exciting a blade whilst it is rotating and to measure the change of natural frequencies due to centrifugal effects. Three of the first four modes of the blade were excited over a range of rotational speeds, and the variations of frequency and damping with rotational speed are given for each mode. Author (ESRO)

N70-12361# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

AN EXPERIMENTAL AND THEORETICAL COMPARISON AT M = 4 OF THE LIFT-TO-DRAG RATIO OF SOME POSSIBLE AIRCRAFT SHAPES

C. S. Brown and E. L. Goldsmith Aeron. Res. Council 1969 35 p refs Supersedes RAE-TR-67-067; ARC-29415

(ARC-R/M-3600; RAE-TR-67-067; ARC-29415) Copyright. Avail: CFSTI; HMSO 18s 6d; BIS $3.60

An experimental and theoretical comparison has been made between two different methods of combining excess cross-sectional area (due to the engine exhaust nozzle exit being larger than the intake entry) with the volume and lifting surface elements in an aircraft configuration. Comparisons of measured and calculated values of $(L/D)_{max}$ have been made using linear theory and in general fair agreement is achieved. A systematic study of the effect of varying the proportions of the configurations studied leads to finding the optimum proportions for either approach. Author (ESRO)

N70-12506# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TURBOMACHINE ROTOR BLADE

A. G. Kebanov 9 Jun. 1969 3 p Transl. into ENGLISH from Russian Patent No. 213465 (Appl. no. 1046342/24-6, 27 Dec. 1965) 2 p

AD-693536; FTD-HT-23-131-69) Avail: CFSTI CSCL 10/1

A turbomachine rotor blade with a shroud flange is described. To improve its rigidity without increasing its weight, the flange has a streamlined configuration. TAB

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N70-11437# Boeing Co., Renton, Wash. Commercial Airplane Div.

A METHOD FOR PREDICTING SHEDDING OF ICE ACCRETIONS

Carl Maes Jul. 1969 61 p refs

(AD-693316;D6-58388) Avail: CFSTI CSCL 1/2

A BETA computer program is used to calculate the leading edge skin temperature beneath ice accreted on unheated airfoil surfaces, and ice shedding altitudes are determined from the transient temperature profiles. The computer model is developed to allow easy variation of flight and atmospheric conditions. A model 737 empennage section is used to illustrate use of the program. Author (TAB)

N70-11493# Massachusetts Inst. of Tech., Cambridge. Mechanical Engineering Dept.

RANDOM VIBRATION IN AEROSTRUCTURES

Dean Karnopp 1 Sep. 1969 9 p refs

(Contract F44620-69-C-0037)

(AD-693620; AFOSR-69-1905TR) Avail: CFSTI CSCL 1/3

The report covers research results in three fairly distinct areas: hysteretic structures; optimizing isolation schemes for reducing the deleterious effects of vibration on sensitive components; and the study of methods for controlling high-order or distributed systems such as flexible aerospace vehicles in such a way that their dynamic characteristics and response to disturbances would be improved without involving significant adverse effects on structural weight and aerodynamic shape. Author (TAB)

N70-11513# Army Foreign Science and Technology Center, Washington, D.C.

OPTIMAL PURSUIT IN THE HORIZONTAL PLANE

V. I. Polkovinkov 15 Aug. 1969 26 p refs Transl. into ENGLISH from Tr. Aviats. Inst. (Kazan), no. 89, 1965 p 138-152

(AD-693145; FSTC-HT-23-313-69) Avail: CFSTI CSCL 15/7

This article represents a mathematical analysis of the motion of two aircraft, one being pursued and the other in pursuit, and of the relationships between their trajectories. The conditions under which the trajectory of the pursuit will lead to contact with the target, and the conditions under which contact will not occur are described mathematically. The trajectories of the aircraft are assumed to be rectilinear. The methods for controlling the trajectory of the pursuit craft are expressed mathematically with the condition of arbitrary thrust constant of the engines and in consideration of the fuel reserves required to accomplish the maneuver. Author (TAB)

N70-11539# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FARTHER, HIGHER AND QUIETER

V. Kvitka et al 18 Jun. 1969 6 p Transl. into ENGLISH from Grazhdanskaya Aviatsiya, no. 9, 1968 p 26-27

(AD-693487; FTD-HT-23-308-69) Avail: CFSTI CSCL 1/3

Present day requirements on a limited noise factor were taken into consideration in the design and construction of the Il-62 aircraft. This was accomplished by using turbofan engines with a comparatively low exhaust velocity of the jet stream and special piloting techniques during takeoff. The NK-8 turbofan engines mounted on the Il-62 have a by-pass ratio approaching m equals 1. Therefore, under takeoff conditions of operation the noise from the principle sources is just about the same. To decrease the noise produced in the immediate vicinity, the takeoff of the Il-62 is performed in the following manner: (1) After liftoff, at a height of 5 to 8 m, the landing gear is retracted. Simultaneously the aircraft accelerates and climbs. The speed is maintained up to H equals 150 m. (2) During acceleration above 150 m, the flaps are retracted from 30 to 15 degrees. The climb to an altitude of 800 m is accomplished with 15 degrees flaps and at a constant speed of 310 to 345 km/hr, depending upon the take-off weight of the aircraft. (3) At an altitude of 800 m in the process of acceleration,

the flaps are fully retracted in such a manner that this operation is completed at the moment the aircraft attains a speed of 400 km/hr. Author (TAB)

N70-11570# Fairchild Hiller Corp., Farmingdale, N.Y. Republic Aviation Div.

F-105F TRANSONIC BUFFET STUDY AND EFFECT OF MANEUVERING FLAPS Final Technical Report, 29 Mar. 1968 - 1 Apr. 1969

Milton Margolin and Jung G. Chung 7 Jul. 1969 241 p refs

(Contract F33657-68-C-1057)

(AD-693650; FHR-3649-1; AFFDL-TR-69-37) Avail: CFSTI CSCL 1/3

The objective of the test program reported herein was the evaluation of maneuvering flaps as a means of increasing the lift of a high performance aircraft at the onset of Mach buffet and decreasing the level of buffet intensity so that the total maneuvering range of the aircraft is increased. The results of this evaluation are presented in this report. Author (TAB)

N70-11624# Army Foreign Science and Technology Center, Washington, D.C.

PURPOSE AND DESIGN OF PARACHUTES

G. Dmitriev 25 Aug. 1969 15 p Transl. into ENGLISH from Kryl'ya Rodiny (Moscow), v. 19, Nov. 1968

(AD-693228; FSTC-HT-23-1098-68) Avail: CFSTI CSCL 1/3

The translation gives a brief historical sketch of the development of the parachute and then goes on to describe, in detail, the design of present-day parachutes, using the D-1-8, series 3 parachute used by the Soviet airborne troops as an example. Author (TAB)

N70-11686# Tactical Airlift Center, Pope AFB, N.C. Office of Operations Analysis.

MINIMUM DROP ALTITUDES AND HORIZONTAL DISTANCES FOR HIGH ALTITUDE, REEFED PARACHUTE DROPS

A. R. Manson Jul. 1969 58 p

(AD-693152; TALC-OA-TM-4) Avail: CFSTI CSCL 1/2

The paper gives a practical method of predicting the minimum drop altitude and the horizontal distance for G-12D, 28-foot ring-slot, and 22-foot ring-slot parachutes for loads using 20, 30, and 40 second squib, disreefing cutters. The statistical methods used are those of multiple regression based on the observed theodolite data from 46 drops. Sufficient detail is given to allow extension of the tabled results to physical situations not specifically included. Author (TAB)

N70-11689# Army Foreign Science and Technology Center, Washington, D.C.

A PARACHUTE CANOPY WITH POCKETS

10 Sep. 1969 6 p Transl. into ENGLISH from Russian Patent no. 193941 (22 May 1967)

(AD-693429; FSTC-HT-23-391-69) Avail: CFSTI CSCL 1/3

The document describes a parachute with pockets on the canopy and holes beneath the pockets designed to admit air at the holes to assure that the canopy will open from the central portion out. Author (TAB)

N70-11690# Army Foreign Science and Technology Center, Washington, D.C.

MULTI-CANOPY CIRCULAR TYPE PARACHUTE SYSTEM

10 Sep. 1969 7 p Transl. into ENGLISH from Russian Patent No. 199687 (8 Sep. 1967)

(AD-693433; FSTC-HT-23-390-69) Avail: CFSTI CSCL 1/3

A parachute final release mechanism in which the last section of the lines attaching the basic shrouds from each parachute to the load is kept coiled, until the desired altitude is reached. At this point the release mechanism permits these lines to run out to their full length. Author (TAB)

N70-11708# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AIRCRAFT NIGHT FLIGHT AND INSTRUMENT FLIGHT

Hui-Fu Liang 16 Jul. 1969 6 p Transl. into ENGLISH from Hang Kung Chih Shih (Mainland China), no. 3 1969 p 26-27

(AD-693457; FTD-HT-23-995-68) Avail: CFSTI CSCL 1/2

The author surveys the general knowledge of night flying and instrument flying which includes: the six categories of meters on the meter panel, the physical and psychological aspects of aviators, training, internal and external lighting system of aeroplanes, airport lightings, and signals of airport control towers. TAB

N70-11826*# National Aeronautics and Space Administration, Washington, D.C.

ANALYSIS OF A JET IN A SUBSONIC CROSSWIND

1969 242 p refs Held at Hampton, Va., 9-10 Sep. 1969

(NASA-SP-218) Avail: CFSTI CSCL 01C

CONTENTS:

1. JET-WAKE CHARACTERISTICS AND THEIR INDUCED AERODYNAMIC EFFECTS ON V/STOL AIRCRAFT IN TRANSITION FLIGHT R. J. Margason (NASA, Langley Res. Center) and R. Fearn (Fla. Univ., Gainesville, Fla.) p 1-18 refs (See N70-11827 02-02)

2. THE PHYSICAL NATURE OF THE SUBSONIC JET IN A CROSS-STREAM J. F. Keffer (Toronto Univ.) p 19-36 refs (See N70-11828 02-02)

3. THE AERODYNAMICS OF THE LIFTING JET IN A CROSS FLOWING STREAM J. E. Hackett and H. R. Miller (Lockheed-Ga. Co., Marietta) p 37-48 refs (See N70-11829 02-01)

4. EXPERIMENTAL INVESTIGATION OF PRESSURES INDUCED ON A FLAT PLATE BY A JET ISSUING INTO A SUBSONIC CROSSWIND H. M. McMahon and D. K. Mosher (Ga. Inst. of Tech.) p 49-62 refs (See N70-11830 02-01)

5. EXPERIMENTAL REACTION JET EFFECTS AT SUBSONIC SPEEDS T. A. Street and D. J. Spring (Army Missile Command, Redstone Arsenal, Ala.) p 63-84 refs (See N70-11831 02-01)

6. A BLOCKAGE-SINK REPRESENTATION OF JET INTERFERENCE EFFECTS FOR NONCIRCULAR JET ORIFICES J. C. Wu and M. A. Wright (Ga. Inst. of Tech.) p 85-99 refs (See N70-11832 02-01)

7. DEVELOPMENT OF AN ANALYTICAL MODEL FOR THE FLOW OF A JET INTO A SUBSONIC CROSSWIND P. T. Wooler (Northrop Corp., Hawthorne, Calif.) p 101-118 refs (See N70-11833 02-02)

8. NUMERICAL TREATMENT OF LINE SINGULARITIES FOR MODELLING A JET IN A LOW-SPEED CROSS FLOW J. G. Skifstad (Purdue Univ.) p 119-130 refs (See N70-11834 02-02)

9. ANALYTIC DESCRIPTION OF JET-WAKE CROSS SECTIONS FOR A JET NORMAL TO A SUBSONIC FREE STREAM R. J. Margason (NASA, Langley Res. Center) p 131-139 refs (See N70-11835 02-01)

10. CROSS WIND EFFECTS ON TRAJECTORY AND CROSS SECTIONS OF TURBULENT JETS G. W. Braun and J. D. McAllister (Tenn. Univ.) p 141-164 refs (See N70-11838 02-01)

11. A GENERAL JET EFFLUX SIMULATION MODEL F. L. Heltsley and R. A. Koreger (ARO, Inc.) p 165-180 refs (See N70-11837 02-02)

12. CALCULATION OF JET INTERFERENCE EFFECTS ON V/STOL AIRCRAFT BY A NONPLANAR POTENTIAL FLOW METHOD P. E. Rubbert (Boeing Co., Seattle, Wash.) p 181-204 refs (See N70-11838 02-02)

13. INVISCID MODELS FOR THE PRESSURE INDUCED BY A JET TRANSVERSE TO A SUBSONIC STREAM R. Rosen, N. A. Durando, and L. A. Cassel (McDonnell-Douglas Astronautics Co., Santa Monica, Calif.) p 205-229 refs (See N70-11839 02-02)

14. THE USE OF MATCHED ASYMPTOTIC EXPANSIONS AS AN APPROACH TO THE PROBLEM OF THE JET IN A CROSS

FLOW J. E. Warner (N.Y. Univ.) p 231–237 refs (See N70-11840 02-02)

15. MASS ENTRAINMENT OF A CIRCULAR JET IN A CROSS FLOW R. L. Fearn (Fla. Univ., Gainesville) p 239–247 refs (See N70-11841 02-01)

N70-11827*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

JET-WAKE CHARACTERISTICS AND THEIR INDUCED AERODYNAMIC EFFECTS ON V/STOL AIRCRAFT IN TRANSITION FLIGHT

Richard J. Margason and Richard L. Fearn (Florida Univ., Gainesville, Fla.) *In its* Analysis of a Jet in a Subsonic Crosswind 1969 p 1–18 refs (See N70-11826 02-02)

Avail: CFSTI CSCL 01C

A summary indicating the general trends of jet-wake-induced aerodynamic effects on V/STOL aircraft in transition flight is given. The jet wake including the adjacent flow field is described qualitatively, and a quantitative measurement of the circulation in the wake is presented. These measurements indicate that the circulation may be somewhat greater than that generated by potential flow around a circular cylinder. Finally, an extensive list of related reports has been included. Author

N70-11828*# Toronto Univ. (Ontario).

THE PHYSICAL NATURE OF THE SUBSONIC JET IN A CROSS-STREAM

James F. Keffer *In* NASA, Washington Analysis of a Jet in a Subsonic Crosswind 1969 p 19–36 refs (See N70-11826 02-02)

Avail: CFSTI CSCL 01C

A description of the physical characteristics of the subsonic jet entering a stream with a non-zero, cross-component is presented. Three zones, in which the dynamics of the flow are significantly different, are defined. The structure of the mean and turbulent motion is discussed with reference to the various entrainment processes. Author

N70-11833*# Northrop Corp., Hawthorne, Calif. Aircraft Div.

DEVELOPMENT OF AN ANALYTICAL MODEL FOR THE FLOW OF A JET INTO A SUBSONIC CROSSWIND

P. T. Wooler *In* NASA, Washington Analysis of a Jet in a Subsonic Crosswind 1969 p 101–118 refs (See N70-11826 02-02)

Avail: CFSTI CSCL 01C

The interaction between a jet exhausting at a large angle from a surface into a subsonic crosswind is discussed. The problem of determining the position of the jet centerline is considered first. An analytical model is discussed which represents the deflecting mechanism by mainstream entrainment and a pressure force. Two methods for obtaining the jet induced velocity field are explored. The first, a vorticity model, is shown to be useful for V/STOL preliminary design. The second method, a sink-doublet model, describes the flow in more detail and is shown to predict wing surface pressure distributions which agree very well with test data. Author

N70-11834*# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.

NUMERICAL TREATMENT OF LINE SINGULARITIES FOR MODELLING A JET IN A LOW-SPEED CROSS FLOW

J. G. Skifstad *In* NASA, Washington Analysis of a Jet in a Subsonic Crosswind 1969 p 119–130 refs (See N70-11826 02-02)

(Grant NGR-15-005-094)

Avail: CFSTI CSCL 01C

A simple analytical model for the jet in a low-speed cross flow, comprising two contra-rotating line cortices and a line sink, is described. The numerical formulation of the nonlinear problem and an iterative procedure for its solution are discussed. Means for achieving a more complete analysis by modifying the simple model are considered. Author

N70-11837*# ARO, Inc., Arnold Air Force Station, Tenn.

A GENERAL JET EFFLUX SIMULATION MODEL

Fred L. Heltsley and Richard A. Kroeger *In* NASA, Washington Analysis of a Jet in a Subsonic Crosswind 1969 p 165–180 refs (See N70-11826 02-02)

Avail: CFSTI CSCL 01C

The complex flow fields induced by V/STOL aircraft in transition flight give rise to an interest in the problem of a jet issuing into a crossflowing stream. The greatest contributor to the induced flow is the roll up and ensuing vorticity of the viscous jet as it penetrates the free stream. This paper describes recent work done both to understand the forces of interaction of the jet and the field and to present a satisfactory mathematical modeling technique which will be useful in aircraft engineering. The results suggest a need for extensive experimental and analytical studies of the jet in a cross flow. Author

N70-11838*# Boeing Co., Seattle, Wash.

CALCULATION OF JET INTERFERENCE EFFECTS ON V/STOL AIRCRAFT BY A NONPLANAR POTENTIAL FLOW METHOD

Paul E. Rubbert *In* NASA, Washington Analysis of a Jet in a Subsonic Crosswind 1969 p 181–204 refs (See N70-11826 02-02)

Avail: CFSTI CSCL 01C

A method of calculating the flow field about V/STOL aircraft with a potential flow model is reviewed with emphasis on the flow modeling requirements. Comparisons with experimental data are used to demonstrate the importance of proper jet simulation. The dominant flow features associated with a jet are reviewed and a theoretical model is proposed which recognizes these features. An experimental program is suggested as a means for determining various parameters appearing in the jet model. Author

N70-11839*# McDonnell-Douglas Astronautics Co., Santa Monica, Calif.

INVISCID MODELS FOR THE PRESSURE INDUCED BY A JET TRANSVERSE TO A SUBSONIC STREAM

Robert Rosen, Norbert A. Durando, and Louis A. Cassel *In* NASA, Washington Analysis of a Jet in a Subsonic Crosswind 1969 p 205–229 refs (See N70-11826 02-02)

(Contract DAAH01-68-C-1919)

Avail: CFSTI CSCL 01C

Methods are presented for approximately predicting the pressure distribution on a flat plate in the vicinity of a transverse jet exhausting into a subsonic uniform stream. A method is formulated for empirically fitting the available data to enable interpolation and extrapolation. This paper presents the formulation of the empirical fit, analysis of the models, and comparison of results from the models with experimental data. The first subject discussed is the formulation of an empirical technique for fitting the data. Following this, results of two approaches to potential modeling of the flow are presented. In the first approach, all of the known significant phenomena, such as entrainment and blockage, are included in an approximate way. Singularities are distributed to account for these effects but their strengths are left arbitrary. A pressure-matching scheme is employed to quantitatively determine the strengths. The potential flow methods used in the second approach are more direct for the purpose of the study. Author

N70-11840*# New York Univ., N.Y.

THE USE OF MATCHED ASYMPTOTIC EXPANSIONS AS AN APPROACH TO THE PROBLEM OF THE JET IN A CROSS FLOW

Jack E. Werner *In* NASA, Washington Analysis of a Jet in a Subsonic Crosswind 1969 p 231–237 refs (See N70-11826 02-02)

Avail: CFSTI CSCL 01C

The method of matched asymptotic expansions is proposed as an approach to the problem of a circular jet issuing from a plane surface into a crossflow. Inner and outer expansions are written in powers of the parameters. Introduction of these expansions into Laplace's equation for the velocity potential results in a series of quasi two-dimensional equations for the terms of the inner expansion. The matching principle is illustrated and the manner in which different models of the flow may be introduced into the theory and compared is discussed. Author

N70-11868# Army Foreign Science and Technology Center, Washington, D.C.
DEVICE FOR RELEASING ACTUATOR CABLE FROM PARACHUTE ASSEMBLY
V. P. Ganin et al 16 Sep. 1969 6 p Transl. into ENGLISH of Russian Patent no. 210673 (Appl. for 2 Nov. 1966) 3 p
(AD-693447; FSTC-HT-23-405-69) Avail: CFSTI CSCL 1/3

The invention describes a hermetically-sealed device equipped with a moveable piston, designed for use in automatic parachute actuation systems. Author (TAB)

N70-11887# Army Foreign Science and Technology Center, Washington, D.C.
PARACHUTE
N. A. Lobanov 16 Sep. 1969 7 p Transl. into ENGLISH from Russian Patent no. 207042 (Appl. for 31 Jul. 1945) 3 p
(AD-693448; FSTC-HT-23-406-69) Avail: CFSTI CSCL 1/3

The invention describes an improved parachute design which provides for the release of the parachute from aircraft traveling at higher speeds. This is accomplished by means of delayed opening of the canopy through the use of a device and a braking parachute. Author (TAB)

N70-11918# Army Foreign Science and Technology Center Washington, D.C.
PARACHUTE CANOPY
I. V. Osmolovskii 16 Sep. 1969 6 p Transl. into ENGLISH from Russian Patent no. 205611 (Appl. 9 Mar. 1966)
(AD-693467; FSTC-HT-23-408-69) Avail: CFSTI CSCL 1/3

The invention describes an improved parachute canopy, equipped with a device which automatically increases the size of the canopy vent under a specified canopy loading condition. Author (TAB)

N70-11921# Army Foreign Science and Technology Center, Washington, D.C.
PARACHUTE
N. A. Lobanov 16 Sep. 1969 6 p Transl. into ENGLISH from Russian Patent no. 207040 (Appl. 28 Aug. 1945)
(AD-693466; FSTC-HT-23-407-69) Avail: CFSTI CSCL 1/3

The invention describes a cargo parachute which is designed to be released from aircraft travelling in excess of 450 km/h. In order to avoid cargo and parachute damage a time-device is employed which delays opening of the parachute by a previously established time interval. The time-delay device is actuated by a pilot parachute. Author (TAB)

N70-12026# Michigan Univ., Ann Arbor. Radio Science Lab.
STUDY AND EVALUATION OF THE OMEGA NAVIGATION SYSTEM FOR TRANSOCEANIC NAVIGATION BY CIVIL AVIATION Final Report, 26 Jun. 1968 – Mar. 1969
Robert E. Scott Aug. 1969 99 p refs
(Contract FA-68-WA-1962)
(SRDS-RD-69-39) Avail: Issuing Activity

The accuracy of the Omega Navigation System operating in an airborne environment and the potential operational utility of the system for civil aviation are evaluated. The error sources of Omega are identified, and their effect on the ability of an aircraft to maintain the desired flight track is evaluated. Characteristics of Omega which are pertinent to operation by civil aviation but which cannot be fully evaluated with available information are identified, and recommendations for further investigations are given. The use of Omega as a navigational aid with Omega signals continuously available at the input of the receiver, with compensation for lane loss, and with an appropriate phase-propagation model would allow aircraft operation at conventional aircraft speeds with r.m.s. cross-track deviations of 3 n.mi if the 10.2 kHz carrier is used for position fixing. The most serious errors would result from failure of lane identification. Several methods of improving resolution reliability in airborne applications are given. Author

N70-12138*# Southampton Univ. (England). Inst. of Sound and Vibration Research.
HELICOPTER ROTOR NOISE, PART 2 Final Report, 1 Dec. 1965 – 30 Nov. 1968
J. W. Leverton Jun. 1969 41 p refs
(Grant NGR-52-025-002)
(NASA-CR-66868; ISVR-311) Avail: CFSTI CSCL 01C

A detailed experimental study was made using the rotor hover rig fitted with 1 to 4 blades. Data and initial observation on some of the results are reported. The discovery of rotational peaks in the vortex region and the advent of rotational noise theories resulted in the main emphasis being placed on rotational (discrete frequency) noise. To determine the applicability of the trends being found on the rotor rig, a detailed analysis was carried out on a series of full scale single rotor blade recordings. Flight tests have also been re-analysed using a narrowband (2 Hz bandwidth) analyser to give real helicopter data. Author

N70-12171# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
THE INFLUENCE OF ELEVATOR MOVEMENT ON THE NORMAL ACCELERATIONS EXPERIENCED BY A TRANSPORT AIRCRAFT IN MODERATE TURBULENCE
D. J. Eckford Jan. 1969 37 p refs Supersedes RAE-TR-69008; (ARC-CP-1060; RAE-TR-69008; ARC-31270) Avail: HMSO 9s; BIS $1.80

Some excerpts from a record of data obtained in an encounter with moderate turbulence during routine operations by a transport aircraft are analysed in order to assess the contribution to the cg normal accelerations from the elevator movement produced by the automatic control system. It is found that this contribution is quite small and does not have a consistent effect on the amplitudes of the accelerations. The influence of an autostabiliser on the response in turbulent conditions is discussed for an idealised situation. From the analytical and numerical results obtained it is seen that the effectiveness of an autostabiliser will usually be strongly frequency-dependent. However, it is suggested that for the case considered here an autostabiliser with a pitch-rate law could give a useful reduction in the cg normal accelerations experienced in turbulence: the most suitable value of the gearing appears to be that which produces a value of about 0.7 for the relative damping of the aircraft's short-period longitudinal mode. Author (ESRO)

N70-12418# National Physical Lab., Teddington (England). Hovercraft Unit.
ESTIMATION OF POWER AND DRAG FOR MARINE HOVERCRAFT. A REVIEW OF THE STATE OF THE ART IN 1969
M. J. Barratt, J. T. Everest, N. Hogben, J. C. Shipway, and J. H. W. Wheatley Sep. 1969 47 p refs
(NPL-Hovercraft-10) Avail: CFSTI

A review is presented of current methods of estimating the power and drag of marine hovercraft taking into account the sensitivity of hovercraft to sea conditions, lift and drag power. A critical appraisal of prediction procedures is attempted. Practice applying to two basic craft types currently in operation, namely peripheral skirt (amphibious and semi-amphibious) craft and immersed solid sidewall (non-amphibious) craft, is included. ESRO

N70-12429# Federal Aviation Agency, Atlantic City, N.J.
EXPERIMENTATION AND EVALUATION OF IMPROVED STALL WARNING EQUIPMENT Final Report

Robert J. Ontiveros Dec. 1969 27 p refs
(NA-69-35; DS-69-15) Avail: CFSTI

A flight simulation project was conducted to determine the relative alerting efficacy of artificial aural and tactile warning signals for alerting pilots to an impending stall condition. Five pilots with current private flying experience participated as subjects in the evaluation of a continuous warning horn signal, an interrupted warning horn signal, and tactile stickshakers with and without an aural (clacker-type) signal. While performing an intricate in-flight pattern task in a flight simulator, pilots were required to respond to aural and tactile warning signals if and when they were detected. The results show that a stickshaker warning signal is the most effective means of alerting a pilot (99 percent effective) followed by an interrupted horn (84 percent effective). The continuous or steady horn, currently used in most aircraft, was only 64 percent effective in alerting a pilot. The results also show that aural signals are least detected when the in-cockpit task or workload requires a high degree of pilot attention. Author

N70-12447# Goodrich (B.F.) Co., Brecksville, Ohio. Research Center.
DEVELOPMENT OF GLASS-FIBER CORD AIRCRAFT TIRE Final Technical Report, 8 Jun. 1964 – 31 Dec. 1968
John M. Foulk May 1969 59 p refs
(Contract AF 33(657)-13481)
(AD-693224; Rept-666-369; ASD-TR-69-86) Avail: CFSTI CSCL 1/3

The purpose of the study was to develop the technology required to produce glass fiber cord aircraft tires. Glass fiber cords and rovings were evaluated for tensile properties, adhesion, and flex-fatigue resistance and Glass fiber cord plied structures were tested as to their compatibility with bias angle tire design or radial construction. Next full size glass fiber cord aircraft tires were constructed and tested. Author (TAB)

N70-12467# RAND Corp., Santa Monica, Calif.
A TWO WAY CONTROLLED SAMPLE FOR COLLECTING TANKER AIRCRAFT BASE MAINTENANCE INFORMATION Technical Report, Apr. 1967 – Feb. 1968
G. C. Sumner Aug. 1969 49 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-692704; RM-6099-PR) Avail: CFSTI CSCL 15/5

The document contains a description from the statistical viewpoint of the sampling design, selection of estimators, and preliminary analysis of maintenance data on KC-135 tanker aircraft of the Strategic Air Command. The aim was to study the effect of aircraft aging on maintenance needs, the relationships between man-hours and other maintenance costs, and sources of error in recording materials consumed. Thirty-three aircraft were selected by a two-stage process so that the sample was stratified by airbase and controlled by age group, while giving all aircraft approximately equal selection probabilities. Author (TAB)

N70-12470# Federal Aviation Administration, Washington, D.C.
SYSTEMS RESEARCH AND DEVELOPMENT SERVICE SCIENTIFIC AND TECHNICAL REPORTS CY-1968
1968 12 p
(AD-692663) Avail: CFSTI CSCL 17/7

The reports were prepared in connection with various scientific or technical projects, tasks, or contracts which support the Service's mission to analyze, formulate and design the improvement and modernization of the National Airspace System, and bear information of interest to the general aviation industry and community. Included for each report are the SRDS code number, title, author, date of the report, and project number, followed by a brief statement regarding the report. Author (TAB)

N70-12673# Computer Sciences Corp., Arlington, Va.
OTHER FIXED-WING AIRCRAFT ATTRITION MODEL (OAATA). USER'S MANUAL Final Report
A. Ross Christensen and L. A. Reynolds 1 Aug. 1969 198 p
(Contract DCA-100-67-C-0040)
(AD-693540; NMCSSC-CSM-SD-90-69) Avail: CFSTI CSCL 1/3

The document describes the Other Fixed-wing Aircraft Attrition (OAATA) FORTRAN IV G level program, developed to support the analysis activity carried out for Systems Analysis, Southeast Asia Programs Directorate (SEAPRO). OAATA is used to project certain fixed-wing aircraft losses based on past and planned future levels of activity and past and planned future levels of activity and past actual losses. Author (TAB)

N70-12704# Bristol Univ. (England)
INVESTIGATION OF THE USE OF AIRJETS AND CHINES ON AIRCRAFT UNDERCARRIAGES USING MODEL WHEELS AND A MOVING GROUND-BELT AND WATER LAYER
London Min. of Technol. May 1969 65 p refs
(Contract PD-34-07)
(S/T-MEMO-10/68) Avail: CFSTI

Tests were carried out on airjets ahead of 9 in. and 14 in. wheels in water layers up to 0.5 in. deep. The configuration and position of the jets was optimised and their effect on drag, aquaplaning velocity and spray was measured. It was concluded that airjets would be a practical and efficient device for aircraft if the difficulties of installation could be overcome. Various chine shapes were tested on the side of an 8 in. solid wheel for their effectiveness in spray deflection. The best chine shapes might not be practical due to their width but could be fitted to a small highly loaded wheel ahead of the main wheel and would delay aquaplaning as well as reduce spray height. Author (ESRO)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N70-11420# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
INVESTIGATION OF A LARGE SCALE NON-EQUILIBRIUM MAGNETOHYDRODYNAMIC GENERATOR Annual Report, 1 Aug. 1968 – 31 Jul. 1969
B. Zauderer Aug. 1969 37 p
(Contract Nonr-3867(00))
(AD-693153) Avail: CFSTI CSCL 10/2

The report briefly summarizes efforts of the past contract year. The following tasks were completed: (a) Development of a uniform pre-ionization system; (b) Large scale MHD power generation in a non-equilibrium plasma; (c) Development of appropriate gas and plasma diagnostic methods for use in the MHD generator; (d) Development of a theoretical model to describe the generator performance; (e) Utilization of the above results to design and construct a new MHD channel. Author (TAB)

N70-11446*# Textron Electronics, Inc., Sylmar, Calif. Heliotek Div.
DEVELOPMENT OF LITHIUM DIFFUSED RADIATION RESISTANT SOLAR CELLS Quarterly Report
P. Payne and H. Somberg 15 Oct. 1969 18 p Prepared for JPL
(Contracts NAS7-100; JPL-952547)
(NASA-CR-106802; QR-1; Rept-3) Avail: CFSTI CSCL 10B

During this quarter, the boron diffusion was the principal area of investigation. This is an important phase since areas of the lithium cell investigation are dependent upon obtaining a relatively stress free boron diffusion, which is impossible with the BCl3 diffusion typically used. Experiments to investigate various material parameters were also designed. The first lot of lithium cells was fabricated and delivered to JPL and an output analysis is included in this report. Author

N70-11627*# Electro-Optical Systems, Inc., Pasadena, Calif.
RESEARCH AND DEVELOPMENT OF ELECTROFORMED ALUMINUM SOLAR CELL CONTACTS AND INTERCONNECTS Periodic Progress Report, 5 Jun. - 4 Oct. 1969
Kenneth Lui 21 Oct. 1969 30 p ref Prepared for JPL
(Contracts NAS7-100; JPL-952485)
(NASA-CR-106850; EOS-4039-Q-1) Avail: CFSTI CSCL 10B

Aluminum contact solar cells using the aluminum electroforming technology are discussed. Photoresist masking, optimization of the plating process, and the effects of sintering are reported. The production of electroformed aluminum contact cells with greater than 10% AMO efficiency is reported, using SiO antireflection coating and no cover slips. Author

N70-11628*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF PUMP TRANSFER FREQUENCIES FROM AUXILIARY POWER TO ALTERNATOR POWER DURING STARTUP OF THE SNAP-8 SYSTEM
Ronald H. Soeder and Roy A. Lottig 13 Nov. 1969 58 p refs
(NASA-TM-X-52712) Avail: CFSTI CSCL 18N

A critical parameter in the startup of the SNAP-8 system is the frequency of the battery-inverter unit that powers the four pumps prior to transfer to the power output of the accelerating turbine alternator. This frequency should be as low as possible in order to reduce inverter power and, hence, battery weight. Pumping requirements during startup, however, dictate a minimum frequency. Startup tests were conducted in which the inverter frequency requirement was determined to be 270 cycles per second. Author

N70-11771# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TURBOMACHINE NOZZLE BLADE
M. E. Deich et al 11 Jun. 1969 4 p Transl. into ENGLISH from Russian Patent no. 216752 (Appl. no. 1048312/24-6, 14 Jan. 1966) 3 p
(AD-693609; FTD-HT-23-130-69) Avail: CFSTI CSCL 10/1

A turbomachine nozzle diaphragm blade with a constant or varying profile along its height is described. The blade back is inversely concave along its height or at the root section beginning with the critical cross-section. To reduce the profile losses over a wide Mach number range, the inversely concave section has a breaking point. In a variation of this blade, the breaking point is connected with the trailing edge by a straight line. TAB

N70-11912*# Electro-Optical Systems, Inc., Pasadena, Calif. Aerospace Systems Div.
COMPUTER PROGRAM FOR PLANETARY SOLAR ARRAY DEVELOPMENT
10 Nov. 1969 84 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952606)
(NASA-CR-107014; EOS-4042-SR) Avail: CFSTI CSCL 10B

This report describes a computer program that will print the power output of a solar panel located arbitrarily on the surface of Mars. The modifications made were to: (1) provide for solar cell model input in terms of 200 (or fewer) points describing the room-temperature I-V characteristics, and up to 25 points for each temperature coefficient, (2) add a subroutine to define the attenuation and scattering as a result of atmospheric dust, including layering on the panel, (3) print out important cell I-V values during three periods of the Martian day, and (4) perform a brief study of the sand dune height expected on Mars. Theoretical calculations of Rayleigh and Mie scattering are derived. The program is included, written in Fortran 4 for an XDS Sigma 7 computer. Instructions are given to prepare the set of necessary input parameters; an explanation and sample printout are given. Author

N70-11968*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
RESULTS OF THE 1968 BALLOON FLIGHT SOLAR CELL STANDARDIZATION PROGRAM
Richard F. Greenwood 1 Dec. 1969 23 p refs
(Contract NAS7-100)
(NASA-CR-106961; JPL-TR-32-1426) Avail: CFSTI CSCL 10B

The difficulty in predicting the space power output of solar cell arrays by means of terrestrial measurements was minimized by the use of high-altitude balloons for solar cell calibration. The use of high-altitude balloons has not only provided standard solar cells but has also furnished a means of lifting radiometers above the earth's atmosphere to measure the solar constant. Author

N70-12002*# Electro-Optical Systems, Inc., Pasadena, Calif.
DEVELOPMENT OF THERMIONIC CONVERTERS Quarterly Report
Dean Jacobson 15 Oct. 1969 10 p Prepared for JPL
(Contracts NAS7-100; JPL-952255)
(NASA-CR-106979; EOS-4018-Q-3; QR-3) Avail: CFSTI CSCL 10A

A program to design and develop low-power, high-efficiency thermionic converters of cylindrical geometry is presented. The converters are capable of being integrated to form a modular power supply for increasing the reliability of thermionic space power supplies by redundancy of the basic component. The converter development is proceeding in an iterative fashion whereby each converter design is reviewed separately and approved by JPL before fabrication. Subsequent performance data are reviewed separately, and will formulate the basis for redesign. Author

N70-12070*# General Electric Co., Philadelphia, Pa. Valley Forge Space Technology Center.
POWER CONDITIONING EQUIPMENT FOR THE THERMOELECTRIC OUTER PLANET SPACECRAFT Quarterly Technical Report, 17 Apr. - 30 Jun. 1969
Roman W. Andryczyk, Frank R. Barry, Theodore J. Ebersole, Alexander Jeremenko, Russell R. Pellman et al 15 Oct. 1969 64 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952536)
(NASA-CR-107013; Rept-1J86-TOPS-479) Avail: CFSTI CSCL 10B

Preliminary design and development activity of the power conditioning electronics for an unmanned outer planet scientific spacecraft with a twelve year life are reported. Requirements of loads are defined; conceptual block diagrams of an inverter, a shunt regulator, a power controller, and a DC to DC converter are presented; and a minimum piece part circuit implementation is established to permit additional trade studies for optimum reliability, weight, efficiency, and cost. The objective was a design to provide regulated power for engineering and science subsystems from a radioisotope thermoelectric generator, and to perform switching and control functions for the effective management and distribution of electrical power. The concept established provides an optimized design to match the power source with the electrical loads, and also provides Peltier cooling at all times to extend thermocouple life. Author

N70-12104*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EFFECTS OF LITHIUM DOPING ON SILICON SOLAR CELLS Conference Proceedings
Paul A. Berman ed. 15 Aug. 1969 70 p refs Conf. held at Pasadena, Calif., 9 May 1969
(Contract NAS7-100)
(NASA-CR-106770; JPL-TM-33-435) Avail: CFSTI CSCL 10B

CONTENTS:

1. DEVELOPMENT OF THE LITHIUM-DIFFUSED SOLAR CELL E. L. Ralph and P. Payne (Textron Electron., Inc.) p 1-7 ref (See N70-12105 02-03)
2. LITHIUM CELL FABRICATION AND CHARACTERISTICS P. A. Iles (Globe-Union, Inc.) p 9-21 (See N70-12106 02-03)
3. THE EFFECT OF LITHIUM DOPING ON SILICON

SOLAR CELLS R. G. Downing (TRW Systems, Redondo Beach, Calif.) p 23–30 (See N70-12107 02-03)

4. ELECTRICAL STUDIES OF ELECTRON-IRRADIATED LITHIUM-CONTAINING SILICON AND SILICON-SOLAR CELLS G. J. Brucker (RCA, Hightstown, N.J.) p 31–44 (See N70-12108 02-03)

5. ANNEALING OF ELECTRON DAMAGE IN LITHIUM-DOPED SILICON AT 300 K J. E. Stannard (NRL, Washington, D.C.) p 45–50 ref (See N70-12109 02-03)

6. PRODUCTION AND ANNEALING OF DEFECTS IN Li-DIFFUSED SILICON AFTER 30-MeV ELECTRON IRRADIATION AT 300 K J. A. Naber, H. Horiye, and R. A. Berger (Gulf Gen. Atomic, San Diego, Calif.) p 51–56 refs (See N70-12110 02-03)

7. STUDY OF DOPANTS FOR RADIATION-RESISTANT SILICON O. L. Curtis, Jr. and R. F. Bass (Northrop Corporate Labs., Hawthorne, Calif.) p 57–64 refs (See N70-12111 02-03)

N70-12105*# Textron Electronics, Inc., Sylmar, Calif. Heliotek Div.

DEVELOPMENT OF THE LITHIUM-DIFFUSED SOLAR CELL

E. L. Ralph and Pat Payne *In* JPL Effects of Lithium Doping on Silicon Solar Cells 15 Aug. 1969 p 1–7 ref (See N70-12104 02-03)

(Contract JPL-952247)

Avail: CFSTI CSCL 10B

Experimental research on cell efficiencies and fabrication of various lithium solar cell types are described. The experimental studies emphasized lithium and boron diffusion techniques, heat treatment effects, antireflection coatings, and storage stability. Current–voltage curves of lithium-diffused p-n cells before and after sintering are given, and lithium cell characteristics after storage are tabulated. Maximum power distributions of fabricated lithium-doped cells are graphed, and it is felt that outputs for all cell designs show good improvements in efficiency over those of the past year. N.E.N.

N70-12106*# Globe-Union, Inc., El Monte, Calif. Centralab Semiconductor Div.

LITHIUM CELL FABRICATION AND CHARACTERISTICS

Peter A. Iles *In* JPL Effects of Lithium Doping on Silicon Solar Cells 15 Aug. 1969 p 9–21 (See N70-12104 02-03)

(Contract JPL-952250)

Avail: CFSTI CSCL 10B

The basic cell fabrication steps, the introduction and distribution of lithium in the cells, and the effect of the lithium and silicon properties on cell performance are described. Cells were made with a lightly etched, lapped finish slice and with a high optical finish. Boron diffusion methods without using boron trichloride gas are reported under investigation. The introduction of lithium into silicon was attempted by using suspension, thermal evaporation, and lithium vapor transport techniques. Paint-on suspensions produced closely controlled cell characteristics. Lithium concentration profiles are graphed and described for the tack-on cycle, drive-in cycle, and redistribution combinations of diffusion temperature and time. Current–voltage characteristics and test results are given for silicon grown by the crucible, float zone, and Lopex, Monex methods. Nonconventional cell structures considered worthy of study are identified as p+–n+–n configuration, oxygen layer structure, lithium introduced from the front surface, and partial compensation of p-silicon by lithium diffusion. N.E.N.

N70-12107*# TRW Systems, Redondo Beach, Calif.

THE EFFECT OF LITHIUM DOPING ON SILICON SOLAR CELLS

R. G. Downing *In* JPL Effects of Lithium Doping on Silicon Solar Cells 15 Aug. 1969 p 23–30 (See N70-12104 02-03)

(Contracts JPL-952251; F33615-68-C-1198)

Avail: CFSTI CSCL 10B

The solar cell evaluation and the kinetics of lithium in silicon are discussed. The characteristics crucible grown and float-zone cells are presented and compared. It is felt that in general crucible-grown lithium-doped cells have higher initial efficiencies, slower recovery times, and better long term stability than float-zone lithium-doped cells at room temperature, and that elevation of the crucible-grown cells to 60-80 C results in annealing times identical to those of float-zone cells at room temperature. The interactions between lithium and radiation-induced defects in silicon were investigated by studying Hall effects, carrier removal rates, capacitance versus temperature, minority carrier diffusion length versus temperature, X-ray topography, redistribution, and other lithium sources. It is considered that initial defects formed in lithium-doped silicon are complex and involve lithium atoms. N.E.N.

N70-12108*# Radio Corp. of America, Hightstown, N.J. Astro-Electronics Div.

ELECTRICAL STUDIES OF ELECTRON-IRRADIATED LITHIUM-CONTAINING SILICON AND SILICON-SOLAR CELLS

George J. Brucker *In* JPL Effects of Lithium Doping on Silicon Solar Cells 15 Aug. 1969 p 31–44 (See N70-12104 02-03)

Avail: CSFTI CSCL 10B

The results of investigations on solar cells, electrical studies on bulk silicon, and lithium-containing silicon are discussed. Radiation recovery and long term stability characteristics of the solar cell were studied, and graphs are presented of the comparison of photovoltaic characteristics of a Lopex cell and a float-zone cell, and a comparison of their donar density profile histories. Ampere–volt characteristics are also given. Emphasis is placed on irradiated bulk silicon research. Data are presented on carrier removal rates, carrier density changes, and mobility changes for quartz-crucible and float-zone lithium-doped silicon. N.E.N.

N70-12109*# Naval Research Lab., Washington, D.C.

ANNEALING OF ELECTRON DAMAGE IN LITHIUM-DOPED SILICON AT 300 K

John E. Stannard *In* JPL Effects of Lithium Doping on Silicon Solar Cells 15 Aug. 1969 p 45–50 ref (See N70-12104 02-03)

Avail: CFSTI CSCL 10B

An experiment is described which was designed to allow a separate determination of the acceptor and donor concentrations in a semiconductor containing one type of acceptor and one type of donor. The sensitivity of the Hall effect was exploited by using a sample that contained less than 10 to the 14th power lithium/cu cm. The results are summarized as follows: Acceptor defects introduced in silicon containing lithium and phosphorus became electrically neutral on annealing at 300 K. A decrease in concentration of both free lithium and lithium–oxygen pairs occurred concurrently with the decrease in acceptor concentration. Lithium was removed much more strongly than would be expected from a mechanism such as precipitation. In all phases of the annealing process, the loss in donor concentration was approximately twice the loss in acceptor concentration. A deep donor level 0.15 eV below the conduction band was observed; its concentration was independent of annealing at 300 K. No A-centers were detected after 61 hr at 300 K. Author

N70-12110*# Gulf General Atomic, San Diego, Calif.

PRODUCTION AND ANNEALING OF DEFECTS IN LI-DIFFUSED SILICON AFTER 30-MeV ELECTRON IRRADIATION AT 300 K

J. A. Naber, H. Horiye, and R. A. Berger *In* JPL Effects of Lithium Doping on Silicon Solar Cells 15 Aug. 1969 p 51–56 refs (See N70-12104 02-03)

(Contract NAS7-289)

Avail: CFSTI CSCL 10B

Measurements of minority carrier lifetime and electrical conductivity were performed. Photoconductivity decay, obtained with the four-probe method, was used for the determination of the minority carrier lifetime. The electron spin resonance measurements

were performed by the use of a superheterodyne spectrometer at 9.2 GHz with the magnetic field modulation at 100 Hz. The samples were vacuum float-zone and quartz-crucible grown phosphorus-doped silicon with initial resistivities of 0.4 4000 ohm-cm. The dominant defects contain lithium or are affected in their production by lithium. The lifetime degradation constant and carrier removal rates are larger in lithium-diffused silicon than in equivalent nonlithium-diffused silicon. The introduction rate of B-1 centers is a strong function of the lithium concentration. Defects are annealed at lower temperatures in lithium-diffused silicon by the diffusion of free lithium to the defect. The electrical conductivity undergoes a reverse anneal during the annealing. Author

N70-12111*# Northrop Corporate Labs., Hawthorne, Calif.
STUDY OF DOPANTS FOR RADIATION-RESISTANT SILICON
Orlie L. Curtis, Jr. and R. F. Bass *In* JPL Effects of Lithium Doping on Silicon Solar Cells 15 Aug. 1969 p 57-64 refs
(See N70-12104 02-03)
Avail: CFSTI CSCL 10B

Silicon was doped with various impurities in an attempt to make the minority carrier lifetime less sensitive to degradation by radiation. The impurities added were aluminum, excess oxygen, beryllium, chlorine, and sodium. The results indicated that both Be and Cl had adverse effects on the electrical properties of the material. Excess oxygen did not appear to improve the radiation tolerance of either n- or p-type material, which seemed somewhat less tolerant than normal Czochralski-grown material. The Na-doped material showed no improvement in radiation tolerance. The greater promise appears to lie with material that was doped with aluminum. Even here the sensitivity to electron irradiation is larger than was anticipated on the basis of neutron irradiation results. Although the relatively high radiation resistance exhibited by Al-doped samples under neutron exposure may be due to the preirradiation heat treatments given these samples, the greater impurity effect apparent in neutron-irradiated samples may be associated with the large fields surrounding disordered regions. Author

N70-12119*# Carnegie-Mellon Univ., Pittsburgh, Pa.
HETEROJUNCTION SOLAR CELL CALCULATIONS
R. Sahai and A. G. Milnes Nov. 1969 32 p refs
(Grant NGR-39-087-002)
(NASA-CR-49827) Avail: CFSTI CSCL 10B

Solar cell efficiencies are computed for feasible semiconductor heterojunction cells of ZnSe - GaAs, GaP - Si, ZnSe - Ge and GaAs - Ge. The analysis includes the loss in efficiency because of reflection, incomplete collection and internal series resistance. Optimum antireflection films are also calculated. The results are compared with the performances expected of Si solar cells and GaAs homojunction cells. ZnSe - GaAs cells are shown to have the potential for exceeding the efficiency of both Si and GaAs cells, if interface recombination losses are small. The output voltage, voltage regulation and temperature performance should be superior to that of Si cells. The window effect in the heterojunction cell may also provide some inherent resistance to deterioration under radiation conditions. Author

N70-12208*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR-CELL PERFORMANCE AT LOW TEMPERATURES AND SIMULATED SOLAR INTENSITIES
Curt H. Liebert and Russell E. Hart, Jr. Washington Dec. 1969 22 p refs
(NASA-TN-D-5547) Avail: CFSTI CSCL 10B

The photovoltaic properties of two commercial CdS thin-film solar cells and 14 silicon solar cells were measured at low temperatures and solar intensities to simulate Jupiter conditions. Also included are measurements at other conditions. All the silicon cells showed acceptable efficiencies ranging from 10 to 11 percent at Earth condition air mass zero, but there were large differences of efficiency at Jupiter conditions. The efficiencies of the best silicon cells and CdS cells at Jupiter conditions were 1.4 and 1.1 times greater, respectively, than near Earth. The efficiencies of the poorer-performing silicon cells ranged from about 1 to 11 percent at Jupiter conditions. At room temperature, the percent change to of fill factor with intensity between 136 and 6 mW/sq cm increased as the efficiency at Jupiter decreased. This suggests that fill-factor monitoring can be useful for sorting out the better-performing cells at Jupiter conditions without resorting to low-temperature tests. Author

N70-12237# Royal Aircraft Establishment, Farnborough (England).
THE EFFICIENCY OF AN AIRCRAFT FUEL BOOSTER PUMP OVER A WIDE SPEED RANGE
R. L. A. McKenzie and R. F. Sims Feb. 1969 27 p ref
(RAE-TR-69027) Avail: CFSTI

The overall efficiency of an ac electrically-driven fuel booster pump over a wide range of frequency has been reported in a general performance study. To find the effect of speed on the efficiency of the pump itself, the input/output characteristics of the motor alone have been measured so that the motor and pump losses could be separated. The maximum pump efficiency varies from 10% at about 2500 rev/min to 37% at about 7500 rev/min. In addition to supplementing the earlier work (RAE-TR-68262), it was considered worthwhile to present the results since they may prove of more general interest regarding centrifugal pump characteristics. Author (ESRO)

N70-12291# Royal Aircraft Establishment, Farnborough (England).
A NEW dc TO dc CONVERTER DESIGN PHILOSOPHY
G. E. Burton Nov. 1968 17 p refs
(RAE-TR-68279) Copyright. Avail: CFSTI

A modular design technique for converters in the kilowatt class is discussed which gives improvements in weight and efficiency. A quarter kilowatt dc to dc converter so constructed has an efficiency of 95% and a weight of 2 kg. A 1% regulation is possible at a slightly reduced efficiency. The converter can have redundancy features and load matching capability. Control circuitry is included in the basic converter design. Author (ESRO)

N70-12427*# General Electric Co., Cincinnati, Ohio.
THREE-STAGE POTASSIUM TURBINE PERFORMANCE TEST SUMMARY
G. C. Wesling Washington NASA Dec. 1969 76 p refs
(Contract NAS3-10606)
(NASA-CR-1483; GESP-271) Avail: CFSTI CSCL 10A

The three stage turbine was tested in potassium vapor at rotative speeds from 15,000 to 20,000 rpm, inlet vapor temperatures of 1450 and 1550 F, and turbine pressure ratios from 3 to 10. The measured total to total efficiency of 78 percent at the design conditions of 18,250 rpm, 1550 F inlet temperature and a total pressure ratio of 7.9 agreed with the performance predictions. The performance calculation model was changed from assumed supersaturated expansion through each stage, with reversion to equilibrium properties at each stage exit, to equilibrium properties at each point in the turbine expansion, based on the results of these performance tests. Author

N70-12428*# Electric Storage Battery Co., Yardley, Pa. Research Center.
ALKALINE BATTERY SEPARATOR CHARACTERIZATION STUDIES Quarterly Report, 28 Apr. - 28 Jul. 1969
J. J. Kelley and S. Orenstein Jul. 1969 25 p refs
(Contract NAS5-10418)
(NASA-CR-107117; QR-7) Avail: CFSTI CSCL 10C

Increased emphasis was placed on the evaluation of the absorber component of conventional alkaline battery separator systems as well as the examination of the procedures used to affect the evaluation. The methods used to measure electrolyte wetting and wicking characteristics of separators were refined and comparative data was obtained. Separator samples of non woven

polyamide, polypropylene and dynel, as well as asbestos, were examined. Scouring, which removed textile processing aids and added wetting agents, made the polyamide samples unable to wick electrolyte. Samples of the scoured material treated to wet in the absence of added wetting agents only partially restored original wicking ability. The treated samples were found to contain large void areas which were not characteristic of the original material. Membrane type separators under test are: 1) a pva grafted polyethylene; 2) polyvinyl alcohol film; and 3) a carboxylic acid grafted cross linked polyethylene. The results of characterization testing are reported. Author

N70-12462*# Naval Ammunition Depot, Crane, Ind.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION SPACE CELL TEST PROGRAM Monthly Progress Report, Oct. 1969
31 Oct. 1969 33 p
(NASA Order W-12397)
(NASA-CR-107116) Avail: CFSTI CSCL 10C

The status report of the spacecraft cell testing program is presented. The list shows the type of cells on test, and the test parameters. Also included are: an explanation of the symbols used on the list, information on active tests, and information on completed tests. F.O.S.

N70-12478*# Battelle Memorial Inst., Columbus, Ohio.
STUDY OF SPACE BATTERY ACCELERATED TESTING TECHNIQUES. PHASE 2 REPORT: IDEAL APPROACHES TOWARDS ACCELERATED TESTS AND ANALYSIS OF DATA
R. E. Thomas, E. W. Brooman, J. H. Waite, O. L. Linebrink, and J. Mc Callum Aug. 1969 118 p refs
(Contract NAS5-11594)
(NASA-CR-107114) Avail: CFSTI CSCL 10C

The object of this program is to develop testing procedures to accelerate the aging of electrochemical cells and batteries so that the equivalent of years of data may be acquired in significantly less time to enable a valid prediction of cell life. In this phase, empirical, statistical, and physical concepts are applied to the design of an ideal accelerated test. Empirical methods of analysis, such as the Automatic Interaction Detector Program, are proposed to search for precursors of failure; statistical methods, such as response surfaces, are proposed for assessing statistical validity and predicting parametric failures during the test; and physical methods based on stress strain laws are proposed for obtaining an understanding of physical mechanisms associated with the degradation of cells with time. Six kinds of stresses are identified in the development of the physical approach to accelerated testing: (1) pressure gradients, (2) voltage gradients, (3) temperature gradients, (4) concentration gradients, (5) velocity gradients (vibrations), and (6) frequency gradients (electromagnetic absorption). Each stress has associated with it a corresponding flux that is identified as a rate of strain. Static strains are also identified for the first four stresses itemized above. Author

N70-12539*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation Lab.
ANALYSIS AND EVALUATION OF SPACECRAFT BATTERY LIFE TEST DATA (PHASE 2) Summary Report
J. R. Kent 17 Oct. 1969 115 p ref
(NASA Order S-23404-G)
(NASA-CR-107119; QE/C-69-665) Avail: CFSTI CSCL 10C

This report presents the mathematical/statistical analysis of data generated by life tests on 660 nickel-cadmium spacecraft battery cells. Three major objectives of the analysis were to: (1) determine the reliability of methods of predicting the useful life of the cells, (2) determine the statistical meaning of data collected during present acceptance testing and whether the acceptance data can be used in making life predictions, and (3) determine if particular failure characteristics or combinations thereof could be related to specific environmental factors. Results of the analysis indicate: (1) about 85% accuracy in predicting the useful life of a cell, (2) the addition of acceptance data to the prediction model is of little value, and (3) failure characteristics were found to be highly correlated with specific environmental factors in several instances. Author

N70-12544*# Naval Ammunition Depot, Crane, Ind.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION SPACE CELL TEST PROGRAM Progress Report, Period Ending 31 Oct. 1969
Oct. 1969 55 p
(NASA Order S-23404-G)
(NASA-CR-107115) Avail: CFSTI CSCL 10B

The test procedures and performance results for the Space Cell Test Program are reported. The tests performed were: (1) separator, (2) open circuit and overcharge, (3) environmental, (4) separator and plate, (5) general performance, and (6) discharge-charge cycling. Test results are tabulated. F.O.S.

N70-12674*# Radio Corp. of America, Princeton, N.J. Astro Electronics Div.
NIMBUS-D SOLAR-CONVERSION POWER SUPPLY SUBSYSTEM Quarterly Technical Report, 16 Jun. - 15 Sep. 1969
15 Oct. 1969 114 p refs
(Contract NAS5-10470)
(NASA-CR-107121; AED-R-3492; QTR-7) Avail: CFSTI CSCL 10B

The Solar Conversion Power-Supply Subsystem consists of eight identical storage modules, one control module, and one solar array. Each storage module contains a battery consisting of 23 series-connected, nickel cadium cells and a group of electronic circuits designed to provide control and protection for the battery and other power subsystem components. These circuits and the battery are housed in cast-magnesium containers with sheet-magnesium covers. The control module consists of additional power subsystem electronic circuits housed in a machined-aluminum container. The solar array consists of two solar-cell platforms containing N-on-P silicon solar cells which are mounted on one side of the sun-oriented platforms. The purpose of the subsystem is to provide the spacecraft with electrical power; during satellite day, the solar array converts solar radiation to electrical energy that is supplied to the spacecraft subsystems and the batteries (charge cycle). During satellite night and peak daytime-load periods, the batteries supply the power to operate the spacecraft subsystems. Author

N70-12691# European Space Research Organization, Paris (France).
PROCEEDINGS OF THE SIXTH ESRO SUMMER SCHOOL, VOLUME 7: SPACE POWER SYSTEMS: APPLICATION
Jul. 1969 68 p refs Partly in FRENCH and partly in ENGLISH Conf. held at Noordwijk, Neth., 1968
(ESRO-SP-46) Avail: CFSTI

CONTENTS:

1. POWER SYSTEMS IN ESRO SATELLITES A. W. Preukschatds (ESRTC) p 1-19 (See N70-12692 02-03)

2. POWER SOURCES FOR EUROPEAN SATELLITES OTHER THAN THOSE OF THE EUROPEAN SPACE RESEARCH ORGANIZATION J. C. Bochet (ESRTC) p 21-36 refs (See N70-12693 02-03)

3. SOLAR CELL POWER SYSTEMS ON US SATELLITES. PART 1: SATELLITES DESIGNED BY THE NASA, GODDARD SPACE FLIGHT CENTER C. M. Mackenzie (NASA, GODDARD Space Flight Center) p 37-54 (See N70-12694 02-03)

4. SOLAR CELL POWER SYSTEMS ON US SATELLITES. PART 2: SATELLITES DESIGNED BY THE JHU, APPLIED PHYSICS LABORATORY R. E. Fischell (Johns Hopkins Univ.) p 55-67 refs (See N70-12695 02-03)

N70-12692# European Space Research and Technology Center, Noordwijk (Netherlands).
POWER SYSTEMS IN ESRO SATELLITES

A. W. Preukschat *In* ESRO Proc. of the 6th ESRO Summer School: Vol. 7: Space Power Systems: Appl. Jul. 1969 p 1–19 (See N70-12691 02-03)
Avail: CFSTI

The paper opens with a discussion of the requirements and general design of a power system that uses solar cells as power source. In the following chapters, detailed summaries are given of the design of the power systems in the ESRO satellites ESRO 1, ESRO 2, and HEOS A, with a description of some of the units.
Author (ESRO)

N70-12693# European Space Research and Technology Center, Noordwijk (Netherlands).
POWER SOURCES FOR EUROPEAN SATELLITES OTHER THAN THOSE OF THE EUROPEAN SPACE RESEARCH ORGANIZATION [SOURCES D'ENERGIE DE SATELLITES EUROPEENS AUTRES QUE LES SATELLITES DE L'ORGANISATION EUROPEENNE DE RECHERCHES SPATIALES]
J. C. Bochet *In* ESRO Proc. of the 6th ESRO Summer School. Vol. 7: Space Power Systems: Appl. Jul. 1969 p 21–36 refs In FRENCH (See N70-12691 02-03)
Avail: CFSTI

A review is presented of power supplies for some European satellites including San Marco, FR-1, D-1, UK-1 and UK-3. Energy sources (solar cells), storage batteries and conditioning and control devices are discussed.
Author (ESRO)

N70-12694# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR CELL POWER SYSTEMS ON U. S. SATELLITES. PART 1: SATELLITES DESIGNED BY THE NASA, GODDARD SPACE FLIGHT CENTER
C. M. MacKenzie *In* ESRO Proc. of the 6th ESRO Summer School. Vol. 7: Space Power Systems. Appl. Jul. 1969 p 37–54 (See N70-12691 02-03)
Avail: CFSTI

This paper describes several types of conversion/energy storage systems in use at Goddard Space Flight Center, in particular those of Explorer 23, Nimbus 2, and ATS 1 satellites. Solar arrays, storage batteries, regulation and performance are discussed.
Author (ESRO)

N70-12695 Johns Hopkins Univ., Baltimore, Md.
SOLAR CELL POWER SYSTEMS ON U.S. SATELLITES. PART 2: SATELLITES DESIGNED BY THE JHU, APPLIED PHYSICS LABORATORY
Robert E. Fischell IN ESRO Proc. of the 6th ESRO Summer School. Vol. : Space Power Systems: Appl. Jul. 1969 p 55–67 refs (See N70-12691 02-03)
Avail: CFSTI

This paper describes several types of conversion/energy storage systems in use at the Applied Physics Laboratory, in particular, those of Transit 1 B, 3 B and 4 B satellites. Solar arrays, storage batteries, regulation and performance are discussed.
Author (ESRO)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N70-11406*# North Texas State Univ., Denton.
[DETECTION AND EVALUATION OF DEFENSES IN SMALL ANIMALS TO SIMULATED SPACECRAFT ENVIRONMENTS] Final Report, 1 Sep. 1968 – 31 Aug. 1969
Rufus K. Guthrie 31 Aug. 1969 62 p
(Contract NAS9-8479)
(NASA-CR-101993) Avail: CFSTI CSCL 06C

The evidence for either the maintenance or the breakdown of natural defenses, or acquired resistance of small animals exposed to simulated spacecraft environment was studied by subjecting guinea pigs to bacterial strains, at a simulated altitude of 380 to 250 mm Hg, in an atmosphere of pure oxygen to 43% oxygen. The test results are tabulated. It is concluded that the stress produced effects on the leukocytes which resembled those of adrenocortical hormone interaction. The depression of antibody titers in guinea pigs which were shifted in environment at the time of antigenic challenge can be considered to be due to one or more of the following: (1) Proliferation of essential germinal centers of antibody production is reduced by the increased hormonal levels which were produced by the nonspecific stress. (2) Relative shifts occurred in mobility of leukocytes and/or monocytes necessary for initial ingestion and processing of the antigen. (3) Initial inflammatory response, often involved in reaction to antigenic stimulus was inhibited by the hormonal production which came when the atmospheric pressure abruptly changed.
F.O.S.

N70-11430* Sensory Systems Lab., Tucson, Ariz.
INITIAL EXPERIMENTS WITH MIGRATING CHELOMIA MYDAS USING TELEMETRY
Howard A. Baldwin, Donald L. Brumbaugh, and Archie Carr Aug. 1968 39 p refs Prepared in cooperation with Florida Univ.
(Grant NGR-03-041-001; Contract Nonr-4315(00))
(AD-693490; NASA-CR-107300) Avail: CFSTI CSCL 06F

This preliminary report describes two initial tracking experiments using transmitting floats attached by line to migrating green sea turtles, Chelonia mydas. Data obtained were incomplete but suggestive that navigation guidance does not depend on olfactory cues in the vicinity of Ascension Island.
Author (TAB)

N70-11433# Boeing Co., Renton, Wash. Commercial Airplane Div.
A COMPUTER PROGRAM FOR CALCULATING ENVIRONMENTAL THERMAL COMFORT
10 Oct. 1969 53 p refs
(AD-693321; D6-58411-1TN) Avail: CFSTI CSCL 1/3

This document presents a method and computer program for calculating thermal comfort zones for various environmental conditions. A model is used which simulates the thermal responses of man at equilibrium. Heat transfer losses are calculated as a function of environmental conditions and a heat stress index defined in terms of the evaporative sweating necessary to maintain body thermal equilibrium. Parameters considered include clothing emissivity, nude body area, metabolic heat production, clothing insulation, effective body area factor, relative humidity, and air velocity. A comfort zone is plotted for mean radiant temperature vs air temperature.
Author (TAB)

N70-11455# Air Force Cambridge Research Labs., Bedford, Mass. Data Sciences Lab.
THE PROGRAMMING (P) HYPOTHESIS FOR REMS
Edmond M. Dewan Jul. 1969 19 p refs *Its* Physical Sciences Research Papers No. 388
(AD-693587; AFCRL-69-0298) Avail: CFSTI CSCL 5/10

The adaptive behavior of higher animals is regarded as implying a spontaneous self-reprogramming process taking place in the brain. This process is assumed to be specifically organized to prepare the animal for its current needs. Secondly, it is then hypothesized that an important part of this takes place during sleep. Then the hypothesis is made more definite by assuming that Stage I-REM sleep (a stage of sleep correlated with subjective dreaming) plays an absolutely fundamental role in this process (that is, it is necessary and sufficient for programming to take place). The consequences of this oversimplified postulate are enumerated in the form of experimental predictions (some of which have already received dramatic confirmation). The main content of this report deals with experimental predictions and theoretical implications which fall into six categories: (1) Physical aspects, (2) memory

aspects, (3) perceptual and sensory-motor aspects, (4) the role of drives and emotions, (5) homeostatic and biorhythmic aspects, and (6) effects of breakdown of programming. Author (TAB)

N70-11480*# National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY A Continuing Bibliography with Indexes
Oct. 1969 118 p refs
(NASA-SP-7011(68)) Avail: CFSTI CSCL 06E

Subject coverage concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Each entry consists of a standard citation accompanied by its abstract. Author

N70-11483*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
THE VISUAL ACUITY IN VIEWING SCALED OBJECTS ON TELEVISION COMPARED WITH THAT IN DIRECT VIEWING
Edward R. Long, Jr. and Sheila Ann T. Long Washington Nov. 1969 24 p refs
(NASA-TN-D-5534) Avail: CFSTI CSCL 06P

The primary objective was to establish a relationship between the visual acuity in viewing scaled objects on television monitors and that in direct viewing. An investigation of the acuity in viewing scaled objects on a closed circuit television system was made. The data were compared with direct-viewing data taken in earlier studies. In both, the acuity was determined as a function of contrast and background luminance. Author

N70-11501# School of Aerospace Medicine, Brooks AFB, Tex.
AUTONOMIC RESPONSE TO AUDITORY STIMULATION DURING SLEEP Final Report, 1 Oct. – 15 Dec. 1967
Richard E. Mc Kenzie Jun. 1969 14 p Submitted for publication
(AD-692982; SAM-TR-69-30) Avail: CFSTI CSCL 6/16

Physiologic data were collected in experiments to determine the extent to which autonomic responses can be evoked in sleeping subjects. The results indicate that no autonomic arousal occurs during sleep in response to verbal stimuli in the form of conditioned nonsense words. Low-level auditory stimulation does produce a generalized effect by altering sleep depth. Author (TAB)

N70-11512# Army Foreign Science and Technology Center, Washington, D.C.
DETERMINATION OF THE PERMEABILITY TO ODORS OF POLYMERIC PACKAGING MATERIALS
V. G. Popovskii 1969 11 p Transl. into ENGLISH from Konserv. i Ovoshchesushil. Prom. (Moscow), v. 23, no. 1, 1968 p 22 – 25
(AD-693064; FSTC-HT-23-227-69) Avail: CFSTI CSCL 13/4

Experiments show aluminum foil to be the only complete protection against penetration by aromatic substances commonly found in fruits and vegetables. A double film of polyethylene and cellophane with a good adhesive is the next best. Other polyethylene based materials are unsatisfactory. Numerical results are given. Author (TAB)

N70-11538# Naval Submarine Medical Center, Groton, Conn.
THE RELATION OF DUCTION TO DYNAMIC STEREOACUITY
S. M. Luria and Paul R. Kent 8 Apr. 1969 14 p
(AD-693470; Rept-575) Avail: CFSTI CSCL 6/5

The relation between duction break-recovery (B/R) ratios and localization error in a test of dynamic stereoacuity was examined in 73 young men. Positive (near) localization errors, esophoria, high negative spherical correction, high adductive and low abductive B/R ratios were found to be related. Positive errors were associated with high adductive and low abductive B/R midpoints for esophores, but the relationship for exophores was not clear. The difference between adductive and abductive B/R ratios increased with increasing positive error. The difference between adductive and abductive B/R midpoints was greater for esophores than exophores and increased with increasing positive error. The magnitude of error was related to the magnitude of the spherical correction which the subject wore during the experiment. The direction and magnitude of the localization errors were not much more predictable from the duction measures than from the phorias. Author (TAB)

N70-11545*# Naval Medical Research Inst., Bethesda, Md. Dept. of Microbiology.
EFFECTS OF HIGH AND LOW BAROMETRIC PRESSURES ON SUSCEPTIBILITY AND RESISTANCE TO INFECTION Quarterly Status Report, 1 Jul. – 30 Sep. 1969
Francis B. Gordon and James D. Gillmore 30 Sep. 1969 14 p ref
(NASA Order R-21-010-010)
(NASA-CR-106831; A-3061A(AS-1); QSR-17) Avail: CFSTI CSCL 06F

An additional experiment has been completed in which observations were made at 2 week intervals on mice being maintained under simulated space cabin atmosphere, hypoxia, or air at ambient pressure. An increased incidence of various types of bacteria was seen in both parabaric groups. The incidence of the various types returned to normal levels when mice were put back to air at ambient pressure in the same chambers following 6 weeks parabaric exposure. In an additional experiment the earlier onset and increased mortality observed in hypoxic mice following challenge with influenza virus was confirmed. Differences between hypoxic and control lung infectivity titers were small. Exposure to hyperbaric-normoxic environments following influenzal aerosol challenge increased the mortality and differences in degree of lung consolidation between test and control groups were in agreement. The effect of hypoxia following intraperitoneal challenge with Coxsackie virus was investigated in mice exposed to simulated 18,000 ft altitude for comparison with previous alterations observed in 11% O at 1 atm. Enhancement of Coxsackie virus infection due to hypoxia was demonstrated by virus titer increase over ambient air control mice. Author

N70-11567# Syracuse Univ., N.Y. Dept. of Physics.
COMPOUND NET MODEL OF THE CEREBRAL CORTEX Final Report, Feb. 1967 – Nov. 1968
Erich M. Harth, B. Beek, T. J. Csermely, and R. D. Lindsay Jun. 1969 72 p refs
(Contracts F33615-67-C-1413; N00014-67-A-0378)
(AD-692719; AMRL-TR-68-189) Avail: CFSTI CSCL 6/3

The central nervous system is believed to consist of a network of neurons, combining in its structure genetically determined design with probabilistic features. A model is described in which probabilistic nets are used as building blocks from which systems can be assembled, approximating for example the interaction between sensory projection areas in the cortex with cortical association areas. The operation of such compound nets is based on the dynamics of single probabilistic nets and on a set of assumptions concerning the coding of sensory information into the language of central neuronal activity. Data describing the dynamics of simple nets are presented. It is found that various types of information processing can be explained by applying the hypothesis of synaptic facilitation to compound nets. Sustained neural activity is investigated, particularly the problem of ergodicity. Highly non-ergodic types of reverberations were found both theoretically and by computer simulation for certain types of nets. Author (TAB)

N70-11602# Indiana Univ., Bloomington. Hearing and Communications Lab.
AUDITORY SIGNAL DETECTION, CORRELATION AND TRANSMISSION Final Report, 1 Oct. 1963 – 15 Aug. 1968
James P. Egan 1 May 1969 22 p refs
(Grants AF-AFOSR-548-64; AF-AFOSR-548-67;

AF-AFOSR-548-65; AF-AFOSR-548-66)
(AD-693629; AFOSR-69-2336TR) Avail: CFSTI CSCL 20/1

The research efforts of the laboratory during the five-year period of the OSR-grants were concerned primarily with two areas of psychoacoustics: (1) the phenomena of masking-level differences, or binaural unmasking, and (2) signal detection theory and psychophysics. The research accomplished is presented in this report as abstracts of the published papers, and are classified under the two headings just mentioned. Author (TAB)

N70-11603*# Public Health Service, Phoenix, Ariz. Applied Microbiology and Planetary Quarantine Section.

SERVICES PROVIDED IN SUPPORT OF THE PLANETARY QUARANTINE REQUIREMENTS

Martin S. Favero Sep. 1969 19 p
(Contract NASr-137)
(NASA-CR-106907; Rept-27) Avail: CFSTI CSCL 06C

The D 125C values for the 103 sporeforming isolates from Mariner-Mars 1969 are being identified for possible correlation between spore type and dry heat resistant type. Levels of microbial contamination in Apollo 11 and quantitative data for the interior and exterior surfaces of lunar module 5 are reported. A total of 1990 and 2041 bacterial colonies were isolated and identified from the Apollo 10 and 11 spacecraft. Biosatellite spacecraft were also tested for microbial contamination. Qualitative and quantitative data from Apollo 10 and 11 were stored in a CDC 3100 computer, and four computer programs were written and tested for compatibility with operating systems. Spacecraft contamination measurements are presented in tabular and graphical representations. J.A.M.

N70-11714# Naval Submarine Medical Center, Groton, Conn. Submarine Medical Research Lab.

VISUAL ACUITY UNDER WATER WITHOUT A FACE MASK Interim Report

S. M. Luria and Jo Ann S. Kinney 19 May 1969 13 p refs
(AD-693472; SMRL-581) Avail: CFSTI CSCL 6/16

Visual acuity was measured under water for subjects without face masks and was compared with their acuity in air. The loss of acuity was around 90 percent for the entire group, but there were marked differences for the various sub-groups. Emmetropes suffered the greatest loss in the water; they required targets more than 20 times as big as those they could see in air. Myopes suffered the least loss; they required an increase in target-size by a factor of only seven. There was no correlation between emmetropic acuity in air and in water. Acuity was also measured at various luminances in air while the subjects wore negative lenses of various powers to induce the same type of out-of-focus vision found under water. High and low contrast targets were used. Calculations were made of the approximate target sizes which can be seen under water at various light levels and at the two levels of contrast. Author (TAB)

N70-11715# Naval Ship Research and Development Center, Annapolis, Md.

THE COMPUTATION AND USE OF CONE-TO-ROD RATIO SPECIFICATIONS

Theodore H. Projector and George K. C. Hardesty Washington Sep. 1969 78 p refs
(AD-693103; ELECLAB-25/69) Avail: CFSTI CSCL 6/16

The note summarizes the principles that underlie the concept of a cone-to-rod ratio (CRR) and supports the use of CRR in evaluating the suitability of light for situations where it is necessary to consider the dark adaptation of personnel. It is pointed out that many existing specifications continue to refer to CRRs that are derived from computations based on a now obsolete table of scotopic visual efficiency. The logical use of the Commission International de lEclairage (International Commission on Illumination) 1951 standard instead of the old data produces CRRs that are quite different numerically but in many instances can be converted from one basis to the other. Figures are given to illustrate the differences. Computational forms are supplied for the entry of spectroradiometric data from sources or of spectral transmittance data from filters to be used with various blackbody light sources as well as several standard nonblackbody sources. Author (TAB)

N70-11717# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TRANSPIRATION OF UPPER AND LOWER SURFACES OF A LEAF AT VARIOUS ORIENTATIONS IN THE EARTH'S GRAVITATIONAL FIELD

V. Z. Kotlyar et al 9 Jun. 1969 9 p ref Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR, Ser. Geol. Geofiz., Khim. Ta Biologiya (Kiev), no. 8, 1967 p 746–750
(AD-693007; FTD-HT-23-468-68) Avail: CFSTI CSCL 6/3

Changes were noted in the transpiration of the upper and lower surfaces of a leaf rotated so the surfaces are 180 degrees from their natural orientation with respect to the earth's gravitational field. Undetached sugar beet leaves were used in the study. When the morphologically lower side of the leaf blade is turned up, its transpiration rate increases rapidly, while the rate for the upper side of the leaf (now in the underneath position) is reduced. The ratio of the upper /lower leaf transpiration is lowered. On returning to its natural position, transpiration of the lower leaf drops and then increases somewhat. Thus, when the leaf is rotated so the gravity vector enters the lower epidermis, transpiration through the upper epidermis is inhibited by the effect of the gravitation field. According to the proposed mechanism for this reaction, when the orientation of the leaf with respect to the gravitational field is changed, the cells regulate the water vapor diffusion process of the stoma breathing cavity differently than when the leaf is in its natural position. Author (TAB)

N70-11741# California Univ., Los Angeles. Graduate School of Business Administration.

DECISIONMAKING UNDER AGGREGATE UNCERTAINTY – THE ENGINEERING DECISIONS IN A SYSTEM DEVELOPMENT PROJECT Final Report

Frederic S. Timson (Ph.D. Thesis) Jun. 1969 224 p refs
(Contract N00014-67-A-0111)
(AD-693213) Avail: CFSTI CSCL 5/1

The report presents a technique for analyzing decisionmaking under aggregate uncertainty. The technique is constructed in such a way that it can be used as a tool to evaluate policies for decision-making or to evaluate the influence of multiple incentive contracts. The technique combines engineering and decision making analyses into a simulation model of system development. The simulation model has two parts: a model of a system development project and a model of the decision and information processes in system development. Author (TAB)

N70-11843# North Carolina Univ., Chapel Hill.

EFFECTS OF IONIZING RADIATION ON PLANT SPECIES, POPULATIONS, AND ECOSYSTEMS Progress Report, 1 Sep. 1968 – 31 Aug. 1969

J. Frank Mc Cormick 31 Aug. 1969 28 p refs
(Contract AT(40-1)-3299)
(ORO-3299-20) Avail: CFSTI

The ecological effects of gamma and beta radiations were analyzed. Studies of species physiology, morphology, growth, and survival under defined conditions were utilized as baselines against which the effects of radiation and other environmental parameters were compared. One specific objective was to analyze the effects of ionizing radiation upon the physiological tolerances of plant species, and the reciprocal effects of physiological stresses upon species radiosensitivities. The effects of gamma and beta radiations on natural ecosystems that contain the same plant species selected for physiological studies in the laboratory were also analyzed. Results of the lab and field studies were compared in an attempt to derive logical hypotheses for ecosystem responses to combinations of radiation and other stresses. Comparisons were made of the

radiosensitivities of major ecosystems of the Southeastern United States. From these comparisons one can predict the ecological effects of nuclear war. NSA

N70-11895*# Naval Aerospace Medical Inst., Pensacola, Fla.
ASSESSMENT OF SEMICIRCULAR CANAL FUNCTION. PART 1: MEASUREMENTS OF SUBJECTIVE EFFECTS PRODUCED BY TRIANGULAR WAVEFORMS OF ANGULAR VELOCITY
Fred E. Guedry, Jr., Gale G. Owens, and Joel W. Norman 16 Jun. 1969 18 p refs Prepared jointly with Army Aeromedical Res. Unit
(NASA Order R-93)
(NASA-CR-106908; NAMI-1073; USAARL-69-7) Avail: CFSTI CSCL 06P

Two methods were compared for measuring subjective angular displacement produced by triangular waveforms of angular velocity while subjects (N = 11) were enclosed in a vertical-axis rotation device that excluded visual and auditory cues of angular motion. Accuracy of subjective estimates was influenced by the methods and by the magnitudes of the accelerations comprising the stimulus waveforms. Results suggest that one of the methods, with slight modification, will provide reliable indication of the subjective effects of controlled semicircular canal stimulation. A follow-up experiment, reported separately, deals with this modification. Author

N70-11982# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
EFFECT OF IONIZING RADIATION ON THE BIOCHEMICAL DIFFERENTIATION OF THE RAT BRAIN
Jean de Vellis and Ole A. Schjeide [1969] 38 p refs
(Contract AT(04-1)-GEN-12)
(UCLA-12-725) Avail: CFSTI

Irradiation (100 R to 1500 R) to the heads of two-day-old rats inhibited differentially the subsequent developmental increases of nucleic acids, individual enzymes, total protein, myelin and total lipid in the rat brain stem and cerebral hemispheres. When irradiation was administered at later ages a decrease in inhibition was observed with increasing age. However, the age at which radioresistance started differed widely between parameters. Glycerol phosphate dehydrogenase (GPDH) (E.C. 1.1.1.8) and isocitrate dehydrogenase (E.C. 1.1.1.42) were radiosensitive during a longer period of their development than malate dehydrogenase (E.C. 1.1.1.37), lactate dehydrogenase (E.C. 1.1.1.27) and malic enzyme (E.C. 1.1.1.40). Myelination was found mostly radioresistant by the time of its onset. Observed inhibitions took place after a delay; they were dose-dependent and showed no recovery to normal levels. Author (NSA)

N70-12000# Laboratoire de Physiologie Acoustique, Jouy-en-Josas (France).
BIOPHYSICAL RESEARCH ON THE CETACEAN'S EAR BONES
Dominique Giraud-Sauveur (Ph.D. Thesis—Paris Univ.) Oct. 1968 117 p refs
(Contract F61052-67-C-0063)
(AD-693217) Avail: CFSTI CSCL 6/3

Certain physical properties of the ossicles of the middle ear in Odontocete Cetacea were studied in relation with the distinct perception of echolocation echoes and of the ultrasonic frequencies which they include. The research was made in comparison with other species, aquatic, amphibious, terrestrial and flying, which employ, or do not employ, sonar systems. Measurements were made for the following points: density, mineral analysis, speed of sound propagation, X-ray diffraction patterns, microradiography and electron microscopy, at once on different ossicles, and in comparison with cranial bones. Author (TAB)

N70-12023*# Avco Corp., Lowell, Mass. Space Systems Div.
MICROBIOLOGICAL INVESTIGATION OF SELECTED SPACECRAFT PARTS AND MATERIALS Final Report
25 Dec. 1967 296 p ref Prepared for JPL
(Contracts NAS7-100; JPL-951577)
(NASA-CR-107009) Avail: CFSTI CSCL 06M

Selected spacecraft parts and materials were assayed for the number of bacteria and fungi on their surface. Data were obtained either for 100 samples of a given part generally divided into 5 separate manufacturing lots or for 25 samples of one lot; frequency distribution of the microbial burden on the parts sampled was obtained. For the assay of each part, the samples were rinsed in peptone water by mechanical shaking or ultrasonication. Aliquots of the rinse solution were then plated on trypticase soy agar and incubated aerobically and anaerobically at 32 C. Data for vegetative bacterial and fungi and bacterial and fungal spores were recorded for each aliquot plate and for the sample part plate. Bactericidal and bacteriostatic assays were carried out on certain aliquot plates and plated samples that exhibited zero counts. A computer program in Fortran 4 was written to compute the averages, standard deviations and values included in frequency distributions. The results indicate low biological burden on most of the parts; in general, electronic components had a lower burden than the polymeric materials. The silicone rubber and potting compounds were found to be highly contaminated. Author

N70-12085# Public Health Service, Las Vegas, Nev. Southwestern Radiological Health Lab.
RADIOIODINE STUDIES FOLLOWING THE TRANSIENT NUCLEAR TEST (TNT) OF A KIWI REACTOR
S. C. Black, D. S. Barth, R. E. Engel, and K. H. Falter May 1969 92 p refs
(SWRHL-26r) Avail: CFSTI

In conjunction with the transient nuclear test of a Kiwi reactor, on January 12, 1965, hay contamination and controlled dairy cow ingestion studies for radioiodines were conducted. The studies were designed to simulate the maximum possible radioiodine uptake by dairy cows under winter dairy farming conditions, where radioiodines enter the cows via ingested, contaminated hay. The kinetics of the secretion of radioiodines in milk under the conditions of this experiment were determined. Peak values of 830 pCi/liter for I-133 and 150 pCi/liter for I-131 were observed in the milk of individual cows. For I-131 the effective half-life in the milk of Group I cows was found to be 5.7 days, whereas for Group II it was 2.9 days. Air sampling results indicated that the contaminant ingested by Group I cows was less gaseous in nature than was the contaminant for Group II cows. NSA

N70-12092*# Ohio State Univ., Columbus.
EFFECT OF SPACE ENVIRONMENT ON MAN'S RESPONSE TO INFECTION A Review of Literature and Annotated Bibliography
Harold V. Ellingson, Joseph F. Tomashefski, Frederick H. Shillito, and John F. Foster Washington NASA Dec. 1969 60 p refs
(Contract NSR-36-008-108)
(NASA-CR-1487) Avail: CFSTI CSCL 06S

A review of the literature on the influence of the space environment to human resistance to infections is presented. Subjects covered are: radiation and infection in space flight, changes in atmospheric composition and pressure, space foods, weightlessness, confinement with minimal hygiene (chamber studies), and combined factors of space Operations. It is concluded: (1) Microbial infections may be a problem during prolonged space flight. (2) Altitude, cold, hypoxia, and other stresses increase susceptibility of some animals to infection. (3) Some noxious trace contaminants are known to increase susceptibility. (4) No changes in autoflora have thus far been detected. Recommendations for additional research, and precautions for protecting crews are included. F.O.S.

N70-12131# Joint Publications Research Service, Washington, D.C.
BIOMEDICAL RESEARCH
In its Upper Atmosphere and Space Res. in the USSR in 1968 1 Aug. 1969 p 42-52 (See N69-12126 02-30)
Avail: CFSTI

Reported are a number of human and animal studies on simulated weightlessness effects using methods of clinical physiology, biochemistry, roentganology, and other techniques. Evaluated were stress factors characteristic for the transition from weightlessness to ground conditions, body changes due to prolonged hypodynamia, as well as radiation exposure effects on mammalian systems and biological specimens. A series of experiments also evaluated life support systems with oxidative-catalytic and oxidative-sorption methods, respectively. Bioengineering work demonstrated that life-support systems based on the regeneration of products of human vital activities successfully cycled matter with high coefficients of regeneration of water and oxygen. G.G.

N70-12151# Naval Oceanographic Office, Washington, D.C.
SOME BIOLOGICAL OBSERVATIONS ON THE WHITE WHALE FROM THE AIRCRAFT [NEKOTORYE BIOLOGICHESKIE NABLYUDENITY ZA BELUKHOI S SAMOLETA]
V. M. Belkovich 1968 19 p refs Transl. into ENGLISH from Zool. Zh. (Moscow), v. 39, no. 9, 1960 p 1414 1422
(AD-693583; NOO-TRANS-403) Avail: CFSTI CSCL 6/3

On the basis of observations on the white whale carried out from the airplane in June and July 1957 in the White, Barents and Kara Seas, it was found that in summer herds of up to 10 animals are prevailing (54.9% of occurrence). Single animals and aggregations of several hundreds are seldom observed (18.1 and 3.2% of occurrence, respectively) and represent a temporary phenomenon. The main constant group of the herd is a female with one-three young of different age; during the breeding season these groups are joined by males, and a mixed herd consists of groups of two-five animals in each. Herds of adult white whales without the young seem to consist of males only which form groups of 3-15 animals. The time of bearing young somewhat shifts in white whales with their advance eastward: in the White Sea they bear young in the mid or the end of June; in Barents Sea in early July, in the Kara Sea in mid-July. Author (TAB)

N70-12195*# Exotech, Inc., Washington, D.C. Systems Research Div.
DEVELOPMENT AND APPLICATION OF A SYSTEM MODEL FOR SPACECRAFT STERILIZATION Final Report
Aug. 1969 87 p refs
(Contract NASw-1558)
(NASA-CR-107041; TR-SR-70-03) Avail: CFSTI CSCL 06M

A mathematical model applicable to the analysis of spacecraft sterilization requirements was developed, based principally on heat sterilization practices. The planetary quarantine implementation model is given in the form: $P(N) \leq R$, where $P(N)$ denotes the probability that the mission contaminates the planet and where R denotes a prescribed maximum allowable value for $P(N)$. The different ways in which heat sterilization can be distributed between a terminal cycle flight acceptance testing and piece-part testing are considered pertinent to the implementation of heat sterilization with a minimization of terminal sterilization time, and the avoidance of heat penetration into materials. Recommendations for modifications, and additional research are included. F.O.S.

N70-12287# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
DETERMINATION OF IRON ABSORPTION AND EXCRETION BY WHOLE-BODY COUNTING [DETERMINATION DE L'ABSORPTION ET DE L'EXCRETION DU FER PAR LA METHODE DE COMPTAGE GLOBAL HUMAIN]
Daniel Hollard, Yvette Benabid, Martine Berard, Jean Bonnin, Jean Darnault et al Aug. 1969 21 p refs In FRENCH
(CEA-R-3542) Avail: CFSTI

Using a whole-body counter, the Fe-59 absorption and loss in 8 normal subjects and in 30 iron-deficient patients was studied. Results showed that whole-body counting provided an excellent and simple method for iron retention measurements, obviating many inaccuracies of previous techniques. Normal absorption of radio iron with this procedure has ranged from 9 percent to 20 percent of the administered tracer in normal subjects, with a mean of 15 per cent. A significant increase in Fe-59 absorption was noted in 21 iron-deficient patients in whom the retention ranged from 40 to 100 per cent. However, 3 iron-deficient patients were found to have low absorption, and their severe iron deficiency would be correlated with this malabsorption. This method permits also the determination of the rate of iron excretion during the following months and therefore the study of the mechanism of some pathological loss. Author (ESRO)

N70-12312# Oak Ridge Associated Universities, Tenn. Medical Div.
COUNTING CHARACTERISTICS OF A MEDIUM-LEVEL WHOLE-BODY COUNTER
Hirotake Kakehi, W. D. Gibbs, and R. L. Hayes Aug. 1969 29 p
(ORAU-108; TID-4500) Avail: CFSTI

The operational characteristics of the diagnostic-level whole-body counter developed at the Oak Ridge Associated Universities, Medical Division are described. This instrument consists of four 3-in. diameter × 3-in. thick sodium iodide crystal detectors mounted in a 1-1/4-in. thick trough-like lead shield and was designed to measure radionuclides in humans in the range from 0.1 to 100 microcuries. Experiments performed and results obtained with the medium-level whole-body counter in a search for distribution-independent energy bands for counting a number of different radionuclides are discussed. NSA

N70-12368# National Bureau of Standards, Washington, D.C.
MICROBIAL CORROSION Technical Summary Report, 1 May 1968 - 30 Apr. 1969
Warren P. Iverson and Joan Calvert 1 May 1969 40 p refs
(AD-693474; NBS-10054) Avail: CFSTI CSCL 11/6

An agar medium which will support good surface growth of marine sulfate reducers (Desulfovibrio) has been devised. Using this medium, a marine isolate of Desulfovibrio has been obtained in pure culture and used for anaerobic corrosion studies. Using polarization techniques for corrosion rate determinations, it was found that the rate of corrosion of mild steel (1020), in a culture of the same medium minus added ferrous ions, decreased to about 0.1 mdd and then increased to 7-8 mdd before termination. These changes were correlated with the formation and removal of an iron sulfide film. A non-marine strain of Desulfovibrio was found to produce a volatile organophosphorous compound which reacts with mild steel to form iron phosphide (Fe2P). It also has the ability to reduce the redox dye, benzyl viologen. The marine isolate also appears to produce this compound. Growth of the marine strain in a sea water medium containing ferrous ions to which trypticase and phytone were added resulted in formation of a black material, which upon heating to 1,204C in a vacuum oven, was found to consist of a mixture of FeS and Fe3P (schreibersite). Author (TAB)

N70-12450# Rochester Univ., N.Y. Dept. of Radiation and Biophysics.
MICROWAVE STANDARDS: A COMPARATIVE ANALYSIS
Sol M. Michaelson 23 Apr. 1969 11 p refs Presented at Ind. Neurol. Congr., Prague
(Contract W-7401-eng-49)
(UR-49-1080; CONF-690617-1) Avail: CFSTI

Factors that must be considered in quantification of the biological response to microwaves are discussed. Recommendations for developing a more rational and realistic approach to the development of standards for human exposure to microwaves are considered. The importance of including biophysical factors in relation to functional responses of the body in the development of standards for maximum permissible exposure is pointed out. Soviet levels for maximum permissible exposures are compared with those

of the United States. The importance of biomedical investigation of specific effects, engineering studies of the characteristics of the equipment, field surveys of power levels actually encountered, and development work on means of protection in establishing maximum permissible levels is pointed out. A table of recommended maximum permissible intensities for radio frequency radiation is presented. Author (NSA)

N70-12502# Joint Publications Research Service, Washington, D.C.

NEW MEASUREMENT TECHNIQUES IN STUDYING THE EFFECT OF SUPERHIGH FREQUENCY FIELDS IN BIOLOGICAL SUBJECTS

V. M. Kolesnikov 12 Nov. 1969 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 12, no. 7, 1969 p 9–12

(JPRS-49239) Avail: CFSTI

Dielectric waveguides are proposed for millimeter range studies using hornradiators. By means of these waveguides, the electromagnetic energy was fed to the structures in an open form and under the protection to the upper layers. The operating conditions of the dielectric waveguides under various biological loads were determined. Author

N70-12579# Akademiya Nauk URSR, Kiev.

HUMAN PERCEPTION OF BIOMETEOROLOGICAL PARAMETERS

K. S. Voychishin and V. N. Mikhaylovskiy *In its* Methods for Collecting and Process. Inform. 1967 p 29–33 refs In RUSSIAN (See N70-12576 02-34)

Avail: CFSTI

The feasibility of using pain feelings in patients suffering from rheumatism as indicators of precipitation was investigated, as well as whether daily drops in atmospheric pressure, temperature, or moisture content may serve as transmitters of biometeorological forecast data. Feelings of pain in the heart or joints experienced by 20 rheumatic children between the ages of 8 and 15 were recorded over a four month period. Results were correlated with precipitation measurements from 10 meteorological stations. Correlation values are depicted using graphs. Changes in atmospheric pressure, temperature, and moisture were not found to be valid carriers of biometeorological data. Transl. by E.C.

N70-12639# California Univ., Livermore. Lawrence Radiation Lab. Bio-Medical Div.

THE CHROMOSOME SCANNING PROGRAM AT THE LAWRENCE RADIATION LABORATORY

Stuart P. Stone, James L. Littlepage, and Bruce R. Clegg 14 May 1969 27 p refs Presented at Pattern Recognition Studies Seminar, New York, 9–10 Jun. 1969 Submitted for publication Sponsored by AEC

(UCRL-71493; CONF-690616-1; Rept-2) Avail: CFSTI

During the past two years, the LRL Chromosome Group has developed a production-line system for its low-dose radiation studies using a FIDAC film reader and a collection of pattern-recognition, data-handling, and statistical programs. Changes in the LRL computer facilities require the conversion of all computer programs and the attachment of our image-processing equipment to a large time-shared computer, a CDC-6600. Author (NSA)

N70-12684*# Avco Corp., Lowell, Mass. Applied Technology Div.

CONTINUATION OF THE DEVELOPMENT OF A TYPICAL MARS LANDING CAPSULE STERILIZATION CONTAINER Research and Technology Implications Report

18 May 1969 28 p

(Contract NASB-20682)

(NASA-CR-102353; AVATD-0081-69-CR) Avail: CFSTI CSCL 06M

Five tasks received major emphasis: (1) the selection of tracer organism, carrier material, surface finish, and spore population for ultrahigh vacuum, ambient control, and ultraviolet exposures, and population survival studies lasting up to eight months; (2) the evaluation of the possible recontamination hazard during space flight and deployment maneuvers including organism survival, conditions for organism release and particle movement in the interplanetary spacecraft environment; (3) laboratory investigations of release mechanisms and spore particle charge characteristics; (4) the development, fabrication, and testing os separation joints, dispersion devices, and witness methods to simulate the release of organism from the unsterile outer surface of the flight hardware; and (5) the development of a probabilistic recontamination model and recommendation for ground test certification. It is concluded that Bacillus globigii bacterial spores are ideal test organisms for long-term sterility certification procedures, that large numbers of microbes are likely to survive the environmental profiles of launch and space flight and present recontamination hazards during the lander deployment phase, and that dry B. globigii spores can be treated as nonconducting spheres. M.H.E.

N70-12679# California Univ., San Francisco. Lab. of Radiobiology.

ENDOGENOUS NON-PROTEIN SULFHYDRYL AND CELLULAR RADIOSENSITIVITY

J. W. Harris May 1969 14 p refs Presented at 2nd Intern. Symp. on Radiosentizing and Radioprotective Drugs, Rome

(Contract AT(11-1)-GEN-10)

(UCSF-10-P-2-75; CONF-690525-1) Avail: CFSTI

Ehrlich ascites tumor cells in vivo and HeLa cells in vitro increased their intracellular nonprotein SH (NPSH) concentration as they moved into and through S phase of cell cycle. Although increasing NPSH coincided with a period of increasing radioresistance, other evidence suggested that the relation may not be a causal one. Chinese hamster cells in plateau growth contained only one-third the NPSH concentration of exponentially growing cells, yet the two were equally sensitive (same D sub 0) to a single dose of X rays. Ehrlich ascites tumor cells treated with methyl phenyldiazenecarboxylate (a specific NPSH oxidant under the conditions employed) were not significantly more radiosensitive than untreated cells, although they contained only 20 to 30% of their normal NPSH complement when irradiated. It was concluded that although endogenous NPSH did fluctuate as cells move around the cell cycle, these fluctuations were probably not the cause of age-dependent radiosensitivity. Author (NSA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N70-11402*# Martin Marietta Corp., Denver, Colo.

FLOOR ANALYSIS AND SPECIFICATION FOR PROTOTYPE MOBILITY AND RESTRAINT FOOTWEAR

A. W. Hanger Nov. 1969 20 p refs

(Contract NAS9-9336)

(NASA-CR-102001; MCR-69-524) Avail: CFSTI CSCL 06K

The magnetic analysis and design specification to determine the lightest weight armature, or floor, configuration of a magnetic circuit are presented. The magnetic characteristics of the permanent magnet, the useful air gap, and the iron armature components of the circuit are given. Vanadium permendur, pure annealed iron, and hot rolled, low carbon sheet metal were investigated for the armature materials. The thickness of the armature to maintain 16.2 pound attractive force was determined, and a method to calculate the permeance is outlined. Vanadium permendur was found to be susceptible to impact with regard to retaining high permeability characteristics. It is recommended that the armature design incorporate a smooth, annealed, pure iron material with a thickness of 0.030 inches. N.E.N.

N70-11403*# Martin Marietta Corp., Denver, Colo.
FINAL ANALYSIS/DESIGN AND PROTOTYPE CONSTRUCTION OF A SELECTED MOBILITY AND RESTRAINT DEVICE Final Report
Arnold W. Hanger, Scott C. Harris, and Arthur A. Rosener Nov. 1969 100 p refs
(Contract NAS9-9336)
(NASA-CR-102003; MCR-69-507) Avail: CFSTI CSCL 06K

Mobility and restraint equipment to date was designed for relatively small volume spacecraft. In these vehicles, the crew was always within touch distance of installed equipment and work areas. In anticipation of larger and more spacious spacecraft, a NASA mobility and restraint concept was designed and prototype articles were fabricated. These articles are known as shufflers and use permanent magnets for a normal holding force. The concept utilizes a shuffling technique where both feet maintain constant contact with the surface. The shuffler's major application will be in transporting bulky equipment and assisting in equipment monitoring and adjustments. Author

N70-11405*# Martin Marietta Corp., Denver, Colo.
FINAL ANALYSIS/DESIGN AND PROTOTYPE CONSTRUCTION OF A SELECTED MOBILITY AND RESTRAINT DEVICE Summary Report
Arnold W. Hanger and Arthur A. Rosener Nov. 1969 19 p
(Contract NAS9-9336)
(NASA-CR-102002; MCR-69-513) Avail: CFSTI CSCL 06K

A mobility and restraint device employing the shuffler technique has been designed as primary footwear with permanent magnets imbedded in the ball and heel areas of the sole. The magnets are sized to meet attractive force requirements. The shuffling technique deviates significantly from previous concepts. Both feet remain in continuous contact with the ferrous surface to assure continuous stab. .y. A low coefficient-of-friction material is placed in the ball area of the foot and a high coefficient-of-friction material is placed in the heel and toe areas. The shuffling movement is facilitated by the permanent magnet in the ball area of the foot. Thg magnet has sufficient strength to maintain contact, but is not strong enough to impede the sliding motion required for this mode of transportation. The pushing force for shuffling originates from the heel area of the foot. Once the shufflers are in place, body twisting, bending, and stretching are readily accommodated. If adjustment must be made outside the man's reach while in a fixed position, simple short shuffling movements can easily reposition the body. In cases when only the individual is involved in transporting bulky or high inertia equipment, a free-fly or swimming mode can be used. The shoes are designed to facilitate easy separation from the floor for this mode. Author

N70-11407*# Amglo Corp., Chicago, Ill.
REFURBISHMENT AND TESTING OF THE INTEGRATED WASTE MANAGEMENT SYSTEM Final Report, Dec. 1968 – Aug. 1969
P. P. Nuccio, T. L. Hurley, F. Chybik, Jr., and R. A. Bambenek Oct. 1969 98 p refs
(Contract NAS9-9014)
(NASA-CR-101994; FR-3080) Avail: CFSTI CSCL 06K

A system for recovering water from metabolic wastes for use in manned space flights of long duration is investigated. The integrated waste management system (IWMS) includes compression distillation units for recovering water from urine, humidity condensate, concentrated water and slurried feces. A 30-day simulated mission test was performed on an around-the-clock basis for seven days each week. Defects in the IWMS are discussed, and recommended improvements are: (1) use of a chemical disinfectant in the flush water, (2) filter-out suspended solids before feeding fecal slurry into still, (3) use of still that operates at saturation temperatures near cabin temperature, and (4) use of pasteurization temperatures to sterilize the stored potable water. F.O.S.

N70-11409*# Texas Research Inst. of Mental Sciences, Houston.
PERIOD ANALYSIS OF THE ELECTROENCEPHALOGRAM OF THE BASELINE DATA FOR GEMINI 7 Final Report
Neil R. Burch 7 Nov. 1969 33 p refs
(Contract NAS9-8254)
(NASA-CR-101998) Avail: CFSTI CSCL 06K

A series of electroencephalograms on flight personnel and later on some astronauts was completed. This report presents the periodic analysis and comparison between normal laboratory situation, simulated flight condition, actual orbital flight, and normative sleep study. Author

N70-11442*# Matrix Corp., Alexandria, Va.
AN ANALYSIS OF ASTRONAUT PERFORMANCE CAPABILITY IN THE LUNAR ENVIRONMENT. VOLUME 1: PERFORMANCE PROBLEMS AND REQUIREMENTS FOR ADDITIONAL RESEARCH
Thomas B. Malone, Henry E. Bender, and Morton H. Kahn 6 Aug. 1969 86 p
(Contract NASw-1751)
(NASA-CR-106806) Avail: CFSTI CSCL 05I

This study was concerned with surveying and evaluating research findings reporting expected astronaut performance capability in the lunar environment. Principal conclusions drawn from the review and assessment of research are that the findings are generally incomplete, sometimes questionable, and even contradictory, and that astronaut performance will be adversely affected by the lunar environment. The primary recommendation presented is that an astronaut performance research program be developed immediately which will focus on the research problems, gaps in available data, and the integration of results from different studies. A second recommendation is that emphasis be placed on the combined effects of multiple factors of the lunar environment rather than relying on analysis of individual effects for describing expected performance. For Volume 2, see N70-10874. Author

N70-11443*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
A MODEL FOR HUMAN CONTROLLER REMNANT Final Report
William H. Levison, David L. Kleinman, and Sheldon Baron 15 Oct. 1968 150 p refs
(Contract NAS8-21136)
(NASA-CR-102297; FR-1731) Avail: CFSTI CSCL 05H

A model was developed for predicting the spectral characteristics of human controller remnant in single-display control situations. Remnant is assumed to arise primarily from underlying psychophysical sources such as: (1) observation noise, (2) motor noise, and (3) time-variations in the controller's describing function. These sources are assumed to be white noise processes that are linearly independent of each other and of the signals circulating through the control system. It is shown that these processes are essentially indistinguishable in terms of their effects on controller behavior, and they are lumped into an equivalent (matrix) multiplicative observation noise source. Author

N70-11451# Illinois Univ., Urbana. Biological Computer Lab.
ACCOMPLISHMENTS SUMMARY 1968/1969 OF THE BIOLOGICAL COMPUTER LABORATORY Scientific Report, 1 Jun. 1968 – 31 May 1969
Heinz Von Foerster 15 Jun. 1969 254 p refs
(Grant AF-AFOSR-67-7)
(AD-693552; BCL-69-2; AFOSR-69-2333-TR) Avail: CFSTI CSCL 6/4

This report summarizes theoretical, applied, and experimental studies in the areas of computational principles in complex intelligent systems, cybernetics, multivalued logic, and the mechanization of cognitive processes. This work is summarized under the following topic headings: properties of complex dynamic systems; computers and the language problem; a conceptual framework for the study of linguistics; axiomatics of self-reproduction; an automatic stochastic predictor and related processes; automata

theory; a method for analyzing complex systems; cascaded computational networks; mathematical modeling of interactions in neurons and nets; an organism with a multilevel goal structure and heterarchic competitive control of its overt behavior; search and evaluation of significant event sequences in automated speech analysis; microscopic physics of information transducers; a visual image processor; tectal organization of Ambystoma Tigrinum; a display technique for neurophysiological data; speech analysis using series expansions; an approach to the elimination of free response distortion of an electrical network; adaptive sampling of speech; speech synthesis; and endocrine modeling. TAB

N70-11569# Denver Univ., Colo. Dept. of Psychology.
THE EVALUATION OF A DYNAMIC VISUAL DISPLAY OF TRANSIENT UNDERWATER ACOUSTIC SIGNALS
Lawrence E. Hardacre and Joseph Halpern Sep. 1969 26 p refs
(Contract N00014-68-C-0383)
(AD-693652; TR-2) Avail: CFSTI CSCL 5/8

Three experiments were designed to evaluate one specific type of visual display of transient underwater acoustic signals. Subjects were provided with acoustic, visual, and redundant acoustic and visual information in an attempt to evaluate the display with respect to the discrimination among three stimulus configurations. The results suggested that intersensory discriminations were superior to discriminations based on either singular mode. The influence of learning factors as potential sources of confounding was discussed. Author (TAB)

N70-11616# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WHAT PSYCHOLOGICAL QUALITIES SHOULD BE CULTIVATED IN PREPARATION FOR FLIGHT TRAINING
Chun-Hsien Lin 1 Jul. 1969 8 p Transl. into ENGLISH from Hang Kung Chih Shih (Mainland China), no. 3, 1960 p 24-25
(AD-693456; FTD-HT-23-994-68) Avail: CFSTI CSCL 5/9

A discussion is presented of the psychological qualities that are essential to any successful aviator. These qualities includes quick and accurate judgement, flexible reactions, good apportionment of attentions, flexibility, harmoneous actions, good memory, steady morale, and strong will power. Author (TAB)

N70-11687# Bunker-Ramo Corp., Canoga Park, Calif. Defense Systems Div.
GUIDE TO HUMAN ENGINEERING DESIGN FOR VISUAL DISPLAYS
David Meister and Dennis J. Sullivan 30 Aug. 1969 168 p refs
(Contract N00014-68-C-0278)
(AD-693237) Avail: CFSTI CSCL 9/3

The report is a compilation of the available human factors information related to the design of visual displays. The subjects covered include human performance, display characteristics and the interactions that must be considered in the design of visual display systems. Author (TAB)

N70-12147# Harvard Univ., Cambridge, Mass.
PROJECT TACT Final Report, Jul. 1964 - Mar. 1968
1 Oct. 1968 40 p refs
(Contract F19628-68-C-0300; ARPA Order 952)
(AD-692782; ESD-TR-69-121) Avail: CFSTI CSCL 5/9

The project objective has been to determine what creative thought processes can best take advantage of new technology in computer hardware and software. The plan has been to acquire or develop on-line computer systems of significant mathematical power, and to explore their use in vivo in teaching and research situations. The main product of project research is THE BRAIN (The Harvard Experimental Basic Reckoning And Instructional Network), an interactive computing system which operates on a standard IBM 360 Model 50 under the standard IBM operating system OS. This working system is easy and flexible to use in mathematical and engineering investigations as well as in teaching, and has been engineered for straightforward exportation from Harvard. Author (TAB)

N70-12152# Information Research Associates, Inc., Waltham, Mass.
A NONPARAMETRIC APPROACH TO PATTERN RECOGNITION. PART 2. THE NON-DISJOINT CASE
Joel Owen and Ernest G. Henrichon, Jr. 4 Oct. 1968 19 p refs
(Contract Nonr-4752(00))
(AD-693144; TR-17) Avail: CFSTI CSCL 9/4

In Part I of this paper, (AD-664 218), a nonparametric discrimination technique was proposed. It was shown there that when perfect discrimination was possible, this technique achieved perfection and in certain cases achieved it with a finite learning phase. In this report, the technique is modified to include the case when perfect discrimination is not possible. It is shown that this procedure yields results which converge in probability to the optimal decision boundaries determined by the likelihood ratio method. Author (TAB)

N70-12179# Royal Air Force, Farnborough (England). Flying Personnel Research Committee.
THE SERVICE TRIAL OF NEW AIRCRAFT EQUIPMENT ASSEMBLIES IN LIGHTNING AIRCRAFT
G. L. Smith Dec. 1968 29 p refs
(FPRC/Memo-243) Avail: CFSTI

The service trial of a new series of garments for the Lightning aircrew which may be worn in six different assemblies is described. The new garments, method of training pilots in their use, and the results obtained from the trial are described. Suggested modifications to the garments, based on comments made by the pilots, are detailed. These modifications should improve the acceptability of the garments, which even in their present form were considered a great improvement on the aircrew equipment assemblies at present in use. Author

N70-12230# Atomic Energy Commission Research Establishment, Risö (Denmark). Accelerator Dept.
MICROBIOLOGICAL CONTROL OF RADIATION STERILIZATION OF MEDICAL SUPPLIES. PART 2: NUMBER OF MICRO-ORGANISMS ON MEDICAL PRODUCTS PRIOR TO STERILIZATION AS A FUNCTION OF THE STORAGE TIME BETWEEN PRODUCTION AND MICROBIOLOGICAL CONTROL
Ebbe Ahrensburg Christensen, Claus Emborg, and Niels W. Holm Apr. 1969 10 p refs
(RISO-194) Avail: CFSTI

Five cc disposable hypodermic syringes were contaminated with a number of different micro-organisms, and the number of surviving organisms per syringe was followed for four weeks after contamination. When stored in a dried condition, E. coli was quickly inactivated, and a considerable decrease in the number of staphylococci was observed. As was expected, endospores of B. subtilis withstood storage in a dried condition very well. Author (ESRO)

N70-12243# Commissariat à l'Energie Atomique, Grenoble (France). Lab. de Radiobiologie.
EVOLUTION OF GLYCEMIA IN THE BLOOD OF MICE IN THE PRESENCE OR ABSENCE OF IMIDAZOLE [EVOLUTION DE LA GLYCEMIE SANGUINE CHEZ LA SOURIS PROTEGEE OU NON PAR L'IMIDAZOLE]
Michel Polverelli and Robert Teoule Aug. 1969 23 p refs In FRENCH; ENGLISH summary
(CEA-R-3809) Avail: CFSTI

Because of its radioprotective properties the action of the heterocyclic compound imidazole on blood sugar levels of mice irradiated with a lethal dose, has been studied. It was found that there was a hypoglycemic action of the imidazole, an abolishment of the post-irradiation hyperglycemia by imidazole and an appreciable difference between male and female towards irradiation. Author (ESRO)

N70-12244# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
EXTRACORPOREAL IRRADIATION OF CALF BLOOD: EFFECTS ON THE LYMPHOCYTES, THE BLOOD-PLATELET FUNCTION, SERIC PROTEINS AND FIBRINOGEN [IRRADIATION EXTRACORPORELLE DU SANG DE VEAU: EFFETS SUR LES LYMPHOCYTES, LA FONCTION PLAQUETTAIRE, LES PROTEINES SERIQUES ET LE FIBRINOGENE]
Daniel Hollard, Michel Suscillon, Yvette Benabid, Evelyne Concord, Michèle Ivanoff et al Aug. 1969 35 p refs In FRENCH; ENGLISH summary
(CEA-R-3864) Avail: CFSTI

The present paper reports the results obtained after extracorporeal irradiation of circulating blood of calves. Animals are divided in 3 groups as follows: control animals (blood circulation without irradiation) calves which received 40 000 rads during 24 hours of continuous irradiation; calves which received the same dose, but administered during a period of 5 days (5 hours every day). It was found that the early lymphopenia which persisted for 7 or 8 weeks may be related to the change of immunoglobulins. A constant hyperfibrinemia (12 g/l) was also discovered and several hypotheses are advanced to explain this phenomenon. Author (ESRO)

N70-12327# Space Sciences, Inc., Waltham, Mass. Biosystems Div.
RESEARCH IN DESIGN AND DEVELOPMENT OF A FUNCTIONAL MODEL OF THE HUMAN NONAUDITORY LABYRINTHS Final Technical Report, May 1966 - Dec. 1967
Laurence R. Young and Jacob L. Meiry Mar. 1969 126 p refs
(Contract AF 33(615)-5038)
(AD-692717; AMRL-TR-68-102) Avail: CFSTI CSCL 6/4

A functional model of the human vestibular system was designed and built. The vestibular model consists of two major subassemblies, a three-axis gimbal system for simulating head motion and a special-purpose analog computer which permits simulation of the semicircular canal and otolith dynamic response and nonlinearities. The gimbal system head simulator can be driven through the computer or independently. The entire 'head' may be placed on an aircraft or in a centrifuge or other motion device. The inner gimbal, representing the skull, carries nine inertial sensors to detect the head motion in inertial space. A three-axis rate gyro package detects angular velocity, as inputs to the six semicircular canals. Six single-axis linear accelerometers, three for each ear, detect the specific force inputs for the otolith gravireceptors. The distance between the two ears may be varied by a physical adjustment. The analog computer provides for simulation of the output of each of the twelve vestibular channels. Author (TAB)

N70-12367# Life Sciences, Inc., Fort Worth, Tex.
HUMAN FACTORS IN FIELD TESTING
W. G. Matheny Apr. 1969 77 p refs
(Contract N00014-67-C-0315)
(AD-693110; LS/TR-69-1) Avail: CFSTI CSCL 1/3

The problem of human factors field evaluation within the Navy was examined for the purpose of formulating recommendations for improved evaluative methods and techniques. It was concluded that human factors evaluation does not receive emphasis or support comparable to that given equipment evaluation or commensurate with the importance of the human operator to the successful functioning of the system. Much more definitive and timely information must be provided the human factors field evaluator, evaluations must be more mission oriented rather than cockpit centered, the role of the mock-up inspection needs redefinition, assignment of trained Navy human factors personnel to advise and assist the contractor during development is recommended as is assignment of contractor human factors personnel during field evaluations, close cooperation between human factors and equipment design evaluation personnel during field evaluation will greatly increase the effectiveness of the evaluation, and a short intensive training course in human factors evaluation problems and methods is recommended for Navy personnel assigned to system evaluation. Author (TAB)

N70-12479# Texas Technological Coll., Lubbock.
PERFORMANCE, RECOVERY AND MAN MACHINE EFFECTIVENESS Semi-annual Progress Report, 1 Sept. 1968 - 28 Feb. 1969
Richard A. Dudek 15 Mar. 1969 64 p *Its* Proposal No. 603
(Contract DAAD05-69-C-0102)
(AD-690843) Avail: CFSTI CSCL 5/5

The report describes the organization and goals of the research team with a detailed account of the experimentation that has been completed within its two basic subefforts: those of organizational and motivational emphasis and those of environmental emphasis, as they affect performance and recovery of human operations. The experimentation within organizational and motivational emphasis cover organization structure investigations, approach-avoidance conflict experimentation, the effect of dietary habits on performance and recovery, instructional ambiguity and its effects on performance, and vigilance behavior and cognition experimentation. The subtask projects within the environmental emphasis area include human performance and recovery under vibratory conditions, physical loading, ionization, and climatic conditions. The facilities and personnel are discussed and 12 papers delivered or published are listed. Author (TAB)

N70-12540# Computer Corp. of America, Cambridge, Mass.
CYCLOPS-3 SYSTEM RESEARCH Final Report, 9 Feb. 1966 - 31 Jan. 1969
Thomas Marill, Kurt Franck, and Elisabeth Turner Mar. 1969 83 p refs
(Contract AF 19(628)-5914)
(AD-693204; AFCRL-69-0323) Avail: CFSTI CSCL 9/2

The aim of the Cyclops project research is the development of techniques for allowing computers to perform visual scene analysis, pre-processing of visual imagery, and perceptual learning. Work on scene analysis and learning has previously been described. The present report deals with research on pre-processing and with further work on scene analysis. The principal pre-processing tool is the local operation. The theory of linear local operations is discussed. A programming system, L-OPS, suitable for experimentation with linear and non-linear local operations is described, as well as the use of L-OPS as a pre-processor for certain classes of pictures. Author (TAB)

N70-12612*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
BIOLOGICAL ISOLATION GARMENT Patent Application
Fred R. Spross, inventor (to NASA) Filed 9 Sep. 1969 11 p
(NASA-Case-MSC-12206-1; US-Patent-Appl-SN-856258) Avail: CFSTI CSCL 06K

The instant invention is directed to a garment for containing biological life forms which may be present on the body of an astronaut returning from the surface of an extra terrestrial body such as the moon. The suit is a completely enclosable, one-piece garment fabricated primarily from a tightly woven, permeable cotton fabric to permit body ventilation while maintaining the required biological containment. All fabrication seams are internally sealed and medical rubber gloves are sealed to the ends of the arms. The novelty of the invention appears to reside in the use of a permeable material in constructing the suit with provision for filtering both inspired and expired breath and the design of the zipper closure which permits rapid sealing and ease in donning and removal of the suit. NASA

N70-12622*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EXTRAVEHICULAR TUNNEL SUIT SYSTEM Patent Application

Joseph J. Kosmo, inventor (to NASA) and Elton M. Tucker, inventor (to NASA) Filed 12 Sep. 1969
(NASA-Case-MSC-12243-1; US-Patent-Appl-SN-857445) Avail: CFSTI CSCL 06K

An extravehicular human work station permitting manual operation in a hostile environment is projected. The work station consists of a semi-anthropomorphic assembly attached to the distal end of a tunnel extending from a vehicle wall. The tunnel is of convoluted bellows construction and may be selectively axially expanded or contracted by a system of individually controlled cables. The cables may be operated individually also in order to regulate the angle from which the tunnel axis projects from the vehicle wall. NASA

N70-12654# Joint Publications Research Service, Washington, D.C.
ON THE COURSE TO AN ARTIFICIAL BRAIN
I. P. Litinetskiy 17 Nov. 1969 64 p Transl. into ENGLISH from the book 'Besedy O Bionike' Moscow, 1968 p 521–592
(JPRS-49263) Avail: CFSTI

A discussion is presented on the functions of the brain, electronic models of the brain, and the use of computers in scientific research and manufacturing, and in various aspects of the national economy. Experiments on memory of animals and man are reviewed, and the role of the neuron is described. Models of the brain are divided into two groups: those which try to create models of nerve cells that reproduce biological functions, and those which try to create models capable of performing flexible logical functions of a neuron. Artrons, neuristors, magnetic integrating neuron devices, and memistors are described. A few of the future uses of computers are identified as weather prediction, automatic flight control for unmanned space vehicles, operations research, and operating equipment under dangerous conditions. The advantages accruing from micromodule development are also emphasized. N.E.N.

N70-12671# Joint Publications Research Service, Washington, D.C.
CYBERNETICS AND TECHNICAL PROGRESS
V. M. Glushkov 1 Dec. 1969 24 p Transl. into ENGLISH from Radyanska Ukr. (Kiev), 16 Sep. 1969 p 3–4
(JPRS-49352) Avail: CFSTI

Cybernetics technology and applications are surveyed. Applications cited include automated production, data processing, economic and management planning, automatic control, and education. J.A.M.

N70-12689# President's Science Advisory Committee, Washington, D.C. Space Science and Technology Panel.
THE BIOMEDICAL FOUNDATIONS OF MANNED SPACE FLIGHT
Nov. 1969 35 p
Avail: SOD $0.45

Ways of optimizing manned space program planning to ensure maximum benefits in the fields of environmental medicine and bioengineering were investigated. Human resource requirements both within NASA and the scientific community were considered. Recommendations are given, emphasizing biomedical applications for post-Apollo manned space flight program planning. The following program priorities are highlighted: biomedical research goals, research facilities, international cooperation, cooperation with academic and industrial centers, organizational structure realignments, and budgetary allocations. E. C.

N70-12702# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Braunschweig (West Germany). Inst. fuer Flugfuehrung.
A METHOD FOR THE DIGITAL RECORDING AND ON-LINE PROCESSING OF PULSE AND RESPIRATION RATE [EIN VERFAHREN ZUR DIGITALEN AUFNAHME UND ON-LINE VERARBEITUNG VON PULS- UND ATEMFREQUENZ]
Hans-Dieter Schenk, Ernst Kohnen, and Eckhart Zietlow May 1969 37 p refs In GERMAN; ENGLISH summary
(DLR-MITT-69-08) Avail: CFSTI

The application of physiological measurements to human factors engineering requires measuring devices available in the field of medicine. The integration of these devices into an existing technical test facility, however, raises some problems. Using pulse and respiration rate measurements for demonstration, a data acquisition and data storage system has been studied using the digital computer available in modern test facilities for human factors engineering research. A description of the sensors used and a listing of an appropriate program for the DEC-PDP8 computer is also given. Author (ESRO)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N70-11417*# GCA Corp., Bedford, Mass. Technology Div.
LUNAR LANDER MASS SPECTROMETER, PHASE 2 Final Report, Apr. 1967 – Dec. 1968
Wallace S. Kreisman Oct. 1969 83 p refs
(Contract NAS5-9393)
(NASA-CR-106812; GCA-TR-69-9-N) Avail: CFSTI CSCL 07D

A breadboard miniaturized sputter source solids analysis mass spectrometer was designed, constructed, and tested to determine its suitability as a lunar mass spectrometric probe. The instrument operated over the mass range of 1 to 100 amu in two segments and was capable of detecting as little as a few ppm of some impurity elements in solids. A low power Penning source was used to generate the primary ion beam. Electric and permanent magnet sector fields provided double focusing of secondary ions sputtered from the sample. Two separate electron multipliers detected the mass peaks. The design, construction, and operation of the instrument are described. Author

N70-11447*# Hughes Aircraft Co., Culver City, Calif. Research and Development Div.
PREPARATION AND CHARACTERIZATION OF THE PYRRONES AS THERMAL STRUCTURAL MATERIALS Annual Summary Report, Jun. 1967 – Sep. 1968
B. G. Kimmel and L. E. Karre Sep. 1968 92 p refs
(Contract NAS1-7381)
(NASA-CR-66853; P69-112) Avail: CFSTI CSCL 07C

The feasibility of preparing foams from polymers formed by the condensation of 3,3'-diamionobenzidine (DAB) with either pyromellitic dianhydride (PMDA) or 3,3'4,4'benzophenone tetracarboxylic dianhydride (BTDA) was investigated. Although good foams were produced by heating of pyrrone solutions and the use of volatile fillers, these methods were not felt to be adaptable to the fabrication of large foam sections. Also as a result of the feasibility studies, no further effort was expended on the nearly intractable PMDA-DAB polymers. Two types of pyrrone foam were developed and characterized: a 30-pound chemically blown foam and a 60-pound syntactic foam. The characterization tests included the determination of the compressive and tensile strength over the temperature range from −100 deg to 700 deg F, thermal conductivity, and specific heat. The results of this characterization indicate that both types of pyrrone foam show promise as thermal structural materials for aerospace applications. Author

N70-11449# Pennsylvania Univ., Philadelphia. Electro Chemistry Lab.
TUNGSTEN BRONZE RELATED NON-NOBLE ELECTROCATALYSTS Semiannual Report, 20 Oct. 1968 – 20 Apr. 1969
J. O'M. Bockris, R. A. Fredlein, B. Lovrecheck, and A. Damjanovic Sep. 1969 57 p refs

(Contract DAAB07-69-C-0077)
(AD-693256; ECOM-0077-1) Avail: CFSTI CSCL 7/4

Titanium, zirconium, vanadium, niobium, tantalum, molybdenum and tungsten disilicides and also zirconium, vanadium, niobium and molybdenum carbides were examined as oxygen electrodes. Steady state potentiostatic experiments were performed on the substrates in rod form, in argon and oxygen saturated 0.1 N sulfuric acid solutions. The data obtained are interpreted in terms of the formation of oxide films on these substrates. The electrochemical growth of sodium tungsten bronze crystals from a melt of sodium tungstate and tungsten oxide has been studied under controlled conditions of temperature, purity of the melt and electrode potential. The rate of growth has been analyzed. Sodium tungsten bronzes incorporating tantalum and niobium have been prepared. Testing of the bronzes as oxygen electrocatalysts is, as yet, incomplete but the pure sodium tungsten bronzes and those containing niobium that have been tested are quite inactive. A considerable enhancement of activity was observed for a bronze containing tantalum.
Author (TAB)

N70-11457# Catholic Univ. of America, Washington, D.C. Vitreous State Lab.

COMPOSITION FLUCTUATIONS IN TWO COMPONENT ISOTROPIC SYSTEMS

P. B. Macedo, G. R.Srinivasan, J. H. Simmons, and P. M. Gammell Jul. 1969 48 p
(Contract N00014-68-A-0506)
(AD-693578; TR-4) Avail: CFSTI CSCL 20/13

The effect of composition gradients up to fourth order in the free energy expansion for an inhomogeneous isotropic system on the intensity of electromagnetic radiation scattered from such a system is considered. An expression for the scattered intensity is derived and tested for three systems for which suitable low angle x-ray scattering data is available. It is found that the present theory satisfactorily accounts for deviations from the classical Ornstein-Zernicke-Debye behavior. The present expression for the scattered intensity is more general than that which has been obtained by expanding the Ornstein-Zernicke direct correlation function to fourth order. The temperature dependence of the free energy of the inhomogeneous fluid is also investigated and, based on the available data for the methanol cyclohexane, it is concluded that the temperature dependence of the second derivative of the free energy with respect to composition evaluated at the critical composition is the same above and below the critical temperature.
Author (TAB)

N70-11461# Maryland Univ., College Park. Inst. for Molecular Physics.

INFRARED SPECTRA OF SIMPLE MOLECULES Final Report, 1 Sep. 1967 - 31 Mar. 1969

William S. Benedict Aug. 1969 42 p refs
(Contract F19628-68-C-0098)
(AD-692943; AFCRL-69-0337) Avail: CFSTI CSCL 7/4

A summary is given of work on new interpretation of features in the spectra of carbon dioxide and water vapor, and of the compilation of tables of lines of those and other molecules for identification of molecular lines in the infrared spectra of the earth and planets.
Author (TAB)

N70-11468# Purdue Univ., Lafayette, Ind.

HIGH PRESSURE MASS SPECTRA AND ION CHEMISTRY OF CARBON SUBOXIDE

J. L. Franklin and Steven M. Shildcrout Jul. 1969 19 p Prepared in cooperation with Rice Univ.
(Contract N00014-67-A-0226)
(AD-693054; TR-Rice-7-PU) Avail: CFSTI CSCL 7/4

Subjecting carbon suboxide, C3O2, to electron bombardment in the ion source of a mass spectrometer results in formation of a great variety of positive ions from ion-neutral reactions at sample pressures up to 0.3 torr. Secondary and higher order ions identified include CxO(+) (x = 3,4,5,6), C sub y O2(+) (y = 3,4,5,6,7,8,9) and C sub z O3(+)(z = 5,7). From consideration of the pressure dependence of ionic abundances, possible reactions are suggested. Insertion of carbon atoms from C3O2 into reactant ions seems to be an important process. Ion-neutral reactions may provide a path for formation of elemental carbon, but there is no evidence here that they lead to polymerization of C3O2. The rate constant for reaction of C2O(+) with C3O2 is (2.1 + or - 0.2) x 10 to the minus 9th power cu cm/molecule/sec.
Author (TAB)

N70-11498# General Dynamics Corp., San Diego, Calif. Space Science Lab.

LOW ENERGY INTERACTION STUDIES BY A MERGING BEAMS TECHNIQUE Final Report, 31 Mar. 1969 - 30 Jun. 1969

Pieter K. Rol Jul. 1969 23 p refs Sponsored in part by Defense Atomic Support Agency
(Contract F19628-69-C-0244)
(AD-693556; GDC-DBE69-006; AFCRL-69-0324) Avail: CFSTI CSCL 7/4

The report presents the results of a study of the charged rearrangement reactions of Na with CO(+) and of K with O2(+), N2(+), NO(+) and CO(+) by a merging beams technique. Cross sections have been determined in the energy range from 0.05 to 10 eV. The cross sections are appreciably smaller than those determined by a mass spectrometric method. Structure in the cross section curve was observed in the CO(+) reactions. An increase in the cross section with increasing energy of the reactants was found to coincide with the transition from a mainly stripping to a mainly rebound reaction.
Author (TAB)

N70-11508# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF URANIUM AND IRON IONS ON CORROSION OF TITANIUM IN SULFURIC ACID SOLUTIONS

A. S. Gryaznova et al 12 Mar. 1969 9 p refs Transl. into ENGLISH from Korroz. Zashch. Konstr. Splavov, Akad. Nauk SSSR, Inst. Fiz. Khim. (Moscow), 1966 p 119 - 123
(AD-693657; FTD-HT-23-1151-68) Avail: CFSTI CSCL 11/6

The introduction of U(6+) and Fe(3+) ions into boiling solutions of dilute H2SO4 brings about a sharp reduction in the rate of corrosion of titanium. The Fe(3+) ion is a more effective passivator of titanium in boiling H2SO4 solutions than the U(6+) ion. The passivating capacity of U(6+) and Fe(3+) ions is connected with the displacement of the potential of titanium into the passive region, due to facilitation of the cathode process and also to the high oxidation-reduction potential of a solution containing U(6+) and Fe(3+) ions.
Author (TAB)

N70-11526# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

KINETICS OF THE THERMAL DECOMPOSITION OF PROPANE

N. P. Galenko et al 9 Jun. 1969 7 p refs Transl. into ENGLISH from Neftepererabotka i Neftekhimiya (Russian), 1967 p 286 - 289
(AD-692641; FTD-HT-23-141-69) Avail: CFSTI CSCL 7/4

The paper reports results obtained from analysis of temperature data related to kinetics of the decomposition of propane under continuous flow operational conditions. The constants obtained by a graphic method, on the basis of experimental and literature values, are reported. The data plotted on a logarithmic scale showed the same straight-line variation in the reaction rate over time for six different temperatures. The values for the reaction rate constant of propane, in the range of 973 degrees K to 1173 degrees K and contact time of 0.005 to 50 sec obtained experimentally, agree well with the calculated values.
Author (TAB)

N70-11543# Air Force Cambridge Research Labs., Bedford, Mass. Research Library.

ON THE DIFFUSION METHOD OF CRYSTAL GROWTH

Odon Landvay Jun. 1969 24 p refs Transl. into ENGLISH from Magy. Fiz. Folyoirat, v. 8, no. 3, 1965 p 231 - 249

(AD-692762; AFCRL-69-0275; Trans-51) Avail: CFSTI CSCL 20/2

The simplest technical method for producing crystals of poorly soluble materials is diffusion growth. Through Diffusion growth nucleation processes may be limited or extended to chosen extent. The location and time of initiation for nucleation are directly calculable if the critical supersaturation or solubility product is known. The modification of nucleation time, duration, speed, time expansion, or contraction of extent may be achieved by simple methods. By the selection of experimental conditions different size distribution crystalline precipitates or macrocrystals may be produced. The latter may reach 1 cm size if system parameters are chosen correctly. The maximum dimensions of crystals produced are determined by the relationship of speed, nucleation, and growth. Largest dimensions through growth are usually exhibited by dendrites, twins, plain crystals, and needles. The so-called space crystals (where all three dimensions of the crystal are nearly equal) are generally smaller than the previous ones. The method has increased importance in cases where usual crystal growth methods may not be employed due ot the characteristics of the crystal to be produced. Author (TAB)

N70-11572*# Techtran Corp., Glen Burnie, Md.
MOLYBDENUM HEXAFLUORIDE MoF6 [L'HEXAFLUORURE DE MOLBDENE MOF6]
Maurice Carles Washington NASA Nov. 1969 23 p refs Transl. into ENGLISH from French report CEA-BIB-124, Sep. 1968 p 1-25
(Contract NASw-1695)
(NASA-TT-F-12702) Avail: CFSTI CSCL 07C

MoF6 is generally prepared by direct synthesis of its components. The molecule is entirely symmetrical in structure; the metal atom is located in the center of an octahedron, the apexes of which are occupied by fluorine atoms. When cold, this compound appears as a crystallized white solid body. It melts around 17.5 C and boils around 35 C under air pressure. Very sensitive to hydrolysis and reduction, molybdenum hexafluoride forms addition compounds with sodium, potassium, rubidium, and cesium fluorides. It also forms complex compounds with nitrile and nitrosyl fluorides and nitrogen oxides. The reactivity of this symmetrical molecule shows the nonsaturation properties of molybdenum regarding coordination. Inversely, the high inertia of sulfur and selenium hexafluoride molecules, which are similar, is to be noted. Author

N70-11597# Catholic Univ. of America, Washington, D.C. Dept. of Physics.
RESEARCH DIRECTED TOWARD THE STUDY OF MOLECULAR COLLISION PROCESSES Final Report, 8 Feb. 1967 - 30 Jun. 1968
Janus W. Quinn 20 Aug. 1969 12 p
(Contract F19628-67-C-0249)
(AD-693573; AFCRL-69-0362) Avail: CFSTI CSCL 7/4

Instrumentation for the measurement of visible light scattering from gases at high pressures is described. A high pressure gas scattering cell for measurement of 90 deg. Rayleigh scattering is described. An apparatus for photomultiplier cooling is also described. Preliminary spectroscopic measurements are also indicated. Author (TAB)

N70-11615# TRW Systems, Redondo Beach, Calif.
THE ELECTROSTATIC PROBE IN A REACTING GAS
George F. Carrier and Francis E. Fendell Aug. 1969 30 p refs Prepared for Bell Telephone Labs., Inc.
(Contracts DAHC60-69-C-0008; DAHC04-67-C0015)
(AD-693291; Rept-D6488-6313-T0-00; AROD-645321-E) Avail: CFSTI CSCL 14/2

When a spherical electrode is immersed in a partially ionized gas and is held at a negative potential relative to the distant gas, ions are attracted and electrons are repelled by the electrode, and a current flows. This report reveals the role of ionization and recombination reactions in determining this current. Author (TAB)

N70-11631# Rensselaer Polytechnic Inst., Troy, N.Y.
CHEMICAL BONDING IN EXCITED ELECTRONIC STATES Final Report, 1 Jul. 1965 - 30 Jul. 1969
Samuel C. Wait, Jr. 20 Aug. 1969 35 p refs
(Contract DA-ARO(D)-31-124-G644)
(AD-692953; Rept-4221.5-C) Avail: CFSTI CSCL 7/4

The electronic and vibrational spectra of the series of compounds fluorene, dibenzofuran (diphenylene oxide) and carbazole were examined for the purpose of studying chemical bonding in electronically excited molecules. Assignments of the ground state vibrational frequencies were made to enable study of the change of vibrational frequency on electronic excitation. Spectra of the compounds in the vapor phase were obtained in the ultraviolet region and assignments of vibronic frequencies were made. Author (TAB)

N70-11632# Oregon State Univ., Corvallis. Dept. of Chemistry.
DISCHARGE MECHANISM OF THE V2O5 ELECTRODE
Kenneth R. Newby and Allen B. Scott 30 Aug. 1969 28 p refs
(Contract Nonr-1286(08))
(AD-693308; TR-4) Avail: CFSTI CSCL 7/4

The behavior of V2O5 single crystals, grown from the melt, during cathodic polarization and recovery, was investigated. The dependence of potential upon pH showed that the only plausible reduction product was a solid oxide or oxyhydroxide, polarization being due to the formation of a solid solution. In the pH range 2.0 - 5.5, the curve of electrode potential vs. time during both polarization and recovery was accurately predicted by an equation, already applied to MnO2, derived from the assumption that the product is removed from the surface by diffusion into the electrode. Using tritium as a tracer, it was shown that hydrogen is incorporated in the electrode during discharge at pH 4.7. The activation energy for diffusion was found to be 6.7 kcal/mole, which is consistent with bipolar diffusion of protons and electrons. Author (TAB)

N70-11663# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF PHOSPHORUS CONTAINING COMPOUNDS BASED ON DIAKYL HYDROQUINONE DERIVATIVES AS ADDITIVES FOR LUBRICATING OILS
I. M. Orudzheva et al 11 Jun. 1969 5 p refs Transl. into ENGLISH from Azer. Neft. Khoz. (Russian), v. 46, no. 9, 1967 p 38 - 40
(AD-693516; FTD-HT-23-116-69) Avail: CFSTI CSCL 11/8

Some phosphites prepared from 2,5-di-tert-butylhydroquinone (I) and 2,5-di-tert-amylhydroquione (II) contg. 6.2-8 percent P, were investigated as additives for a diesel oil. The stability of the oil with 0.1 percent of these additives, detd. as time necessary for absorbirig 10 ml. O at 175F, increased from 255 to 340-388 min. The corrosiveness of the oil with 1 percent additives decreased from 360 to 57-0.9 g./sq. m in the presence of 0.02 percent Cu naphthenate at 140 degrees for 25 hrs. Also, the gum-formation coeff. decreased simultaneously. The most efficient were the additives prepd. by condensation of phenyl-, and p-tert-amylphenylphosphorous acids with I and II, regarding both stability and anticorrosive properties. The formulas of the additives and their effects on the corrosiveness and stability of the oil are tabulated. Author (TAB)

N70-11679# Pennsylvania Univ., Philadelphia.
A CHEMICAL INFORMATION AND DATA SYSTEM Semiannual Report, 1 Oct. 1968 - 28 Feb. 1969
Clarence T. Van Meter, Ruth V. Powers, Morris Plotkin, and Helen N. Hill Edgewood, Md. Army, Edgewood Arsenal 28 Feb. 1969 19 p refs
(Contract DAAA15-68-C-0140; Proj. CIDS)
(AD-693304) Avail: CFSTI CSCL 5/2

The document describes research and development activities in progress under Project CIDS designed to advance the experimental chemical information and data system to the status of a model

operational system. It treats primarily of the revision of the chemical search screens, an exploratory technique for incorporating nonstructural information and data, and various improvements in search techniques. It reports the development and operability of a multi-terminal real-time system which is capable of processing queries concurrently from four terminals, and it summarizes experience with the cathode ray tube as an input-output device. It also reports the status of initial file construction for the model operational system. Author (TAB)

N70-11681# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.
INFRARED SPECTRA AND GEOMETRY OF MATRIX ISOLATED DIBORON TETRACHLORIDE AND TETRAFLUORIDE – RAMAN SPECTRA OF THE LIQUIDS
Larry A. Nimon, K. S. Seshadri, David White, and R. C. Taylor 22 Sep. 1969 37 p refs
(Contract N00014-67-A-0216)
(AD-693614; TR-4) Avail: CFSTI CSCL 7/4

The infrared spectra of diborontetrachloride and diboron tetrafluoride molecules isolated in a matrix of solid argon at liquid hydrogen temperature along with the Raman spectra of the two compounds in the liquid phase are reported. Also reported are the 11B-10B isotopic shifts of the fundamental vibrations which were used to establish the molecular symmetry. The infrared spectra of the isotopically substituted molecules of both compounds clearly indicate a geometry in the matrix which is that of the gas phase species, namely, one of V(d) molecular symmetry. The Raman data also support a staggered configuration for B2Cl4 and B2F4 in the liquid phase. These data combined with the matrix infrared results are used to obtain a force constant analysis of both molecules using a Urey-Bradley force field. Author (TAB)

N70-11682# Pennsylvania State Univ., University Park. Spectroscopy Lab.
HIGH RESOLUTION SPECTROSCOPY AND LIGHT SCATTERING Final Report, Jan. 1955 – Sep. 1969
D. H. Rank 30 Sep. 1969 17 p refs
(Contract Nonr-656(12))
(AD-693645) Avail: CFSTI CSCL 14/2

A brief summary of the results obtained in seventy publications is included. Titles, authors and places of publication of these papers which have been included in technical reports are given. They are grouped under the headings: Techniques and instrumentation for high resolution molecular spectroscopy; Determination of the speed of light; Standard wavelengths for the infrared; Molecular spectroscopy; Broadening and frequency shifting of spectral lines; Gas-phase complexes; Quadrupole spectrum of hydrogen; Spontaneous scattering; and Stimulated scattering. Names of the faculty and graduate students who have participated are included. Author (TAB)

N70-11688# Princeton Univ., N.J. Dept. of Physics.
FUNDAMENTAL PROCESSES IN GASEOUS REACTIONS Final Report
Donald F. Homig and George E. Leroi Aug. 1969 13 p refs
(Contract Nonr-1858(26))
(AD-693164) Avail: CFSTI CSCL 7/5

Fundamental processes in gas phase reactions (primarily decomposition and recombination reactions of simple diatomic and triatomic molecules) were studied using shock wave techniques. The investigation of energy transfer processes covered more areas (laser chemistry and vacuum ultraviolet spectroscopy). A vacuum UV monochromator was designed and constructed in the laboratory, and a quadrupole mass spectrometer added later for use in studying pre-ionization and fragmentation of molecules which had absorbed high energy light. Laser photochemistry was shown to be an interesting and powerful technique for exciting molecules, and several two-photon absorptions leading to chemical reactions were demonstrated. Author (TAB)

N70-11694# Aerojet-General Corp., Los Angeles, Calif. Space Div. Center for Research and Education.
NONSPECIFIC CARBORANE PRODUCING REACTIONS
Robert E. Williams, F. J. Gerhart, George I. Hickley, and Jerome F. Ditter 4 Aug. 1969 36 p refs
(Contract Nonr-4381(00))
(AD-693314; TR-18) Avail: CFSTI CSCL 7/2

This is an interim report with the primary purpose of reporting the almost incredible number of the various types and kinds of carboranes that can exist, in this case formed by the high temperature co-pyrolysis of nido-carborane-diborane mixtures and by explosions of diborane-acetylene mixtures. In both cases because of very short residence times, several thermodynamically unfavored isomers survived, while the high temperatures led to many species apparently coupled through boron-boron bonds. Standard analytical gas chromatography in conjunction with intermediate resolution mass spectroscopy was not capable of completely separating and identifying most of these species, but despite this handicap several new isomers of C2B5H7, C2B7H9 and C2B8H10 were identified with certainty. Interestingly, more of the C2B8H10 and C2B10H12 isomers than the intermediate closo-carboranes were formed. One might compare this result to the favored production of their isoelectronic isomers, B10H10(2-) and B12H12(2-), in the synthesis of the BnHn(2-) series. Author (TAB)

N70-11698# School of Aerospace Medicine, Brooks AFB, Tex.
ENAMEL SOLUBILITY REDUCTION BY STANNOUS HEXAFLUOROZIRCONATE Final Report, Jan. – Mar. 1967
Ira L. Shannon and Vincent A. Segreto May 1969 10 p refs
(AD-692981; SAM-TR-69-28) Avail: CFSTI CSCL 6/5

Solutions of stannous fluoride, solutions of stannous hexafluorozirconate, and solutions of stannous fluoride plus zirconium fluoride were compared as to their ability to reduce enamel solubility. All solutions were so prepared as to contain tin in amounts equal to solutions having 10%, 0.5%, and 0.1% stannous fluoride. Solutions of stannous hexafluorozirconate were significantly more effective than those of stannous fluoride containing equivalent tin. The performance of these stannous hexafluorozirconate solutions was not, however, different from that of solutions prepared by separate additions of identical amounts of stannous fluoride and zirconium fluoride. Thus, combining these two components into a single compound does not increase the protective potential above that provided by the separate compounds. The 16% and 24% concentrations of stannous hexafluorozirconate employed in a recent clinical study may be much higher than required. Equivalent reduction of enamel solubility resulted with solutions containing approximately 1/20 of these levels. Author (TAB)

N70-11703# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIS OF THE ANTIOXIDATION ADDITIVE NKhP-21
A. M. Kulien et al 2 Jun. 1969 5 p Transl. into ENGLISH from Russian J. 1967 p 3–8
(AD-693607; FTD-HT-23-70-69) Avail: CFSTI CSCL 11/8

INKhP-21 antioxidation additive was synthesized by condensation of alkylphenols with formaldehyde in the presence of ammonia. The purpose was to prepare an antioxidation additive containing phosphorus, sulfur, and nitrogen. The condensation involved heating a suitable mixture of components for 30-40 min at 90C. The INKhP-21 additive contains: 2.2-3.0% P, 3.0-3.8% S, and 2.0-3.0% N. Its ash content is 15-18 percent. It was found that 1 percent of INKhP-21 significantly improves anticorrosion and antioxidation properties of D-11 diesel oil. Author (TAB)

N70-11704# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYDROBORATION
Cheng Chang 18 Jun. 1969 21 p refs Transl. into ENGLISH from Hua Huse T'ung Pao (Chinese), no. 12, 1962 p 6–12
(AD-692634; FTD-HT-23-996-68) Avail: CFSTI CSCL 7/3

The article reviews recent literature on hydroboration with emphasis on hydroboration of alkenes and alkynes. Topics covered in the review include the following areas: General operation of hydroboration; Synthesis of boranes; Directive action of the boron-hydrogen bond during synthesis; Process and stereochemistry of hydroboration; Protonolysis of the organic boranes; Hydroboration of diolefin with alkynes; Thermal reaction of organic boranes and their applications; and Other applications of hydroboration. TAB

N70-11705# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

POLYMERIZATION OF N N'-DIALLYL AMIDES IN THE SOLID PHASE

F. F. Scherbina et al 9 Jun. 1969 6 p refs Transl. into ENGLISH from an UKRRSR. Dop. Ser. B. Heoi, Heofiz. Khim. Ta Biol. (Ukranpan), v. 29, issue 7, 1967 p 639-641
(Contract C33657-68-08622P002)
(AD-693419; FTD-HT-23-1104-68) Avail: CFSTI CSCL 7/5

N, N-Diallylamides of dicarboxylic acids were polymd. in the solid state at room temp. and under Co irradn. (1060 rads/sec.) Aliphatic amides polymerized faster than aromatic amides. Thus polyamides of N, N-diallylamides of oxalic, malonic, succinic, glutaric, adipic, sebacic, and ethylmalonic acids were obtained in 86-96% yields and phthalic, isophthalic, and terephthalic acids in 41-72% yields. With the exception of poly(N, N-diallyloxalamide) which was pink, the prepared aliphatic polyamides were yellow, and the aromatic polyamides were red-violet. By subsequent irradiation of yellow crystalline poly (N, N-diallylmalonamide) the polymer became blue, apparently, due to the presence of free radicals, which decayed with time. Author (TAB)

N70-11746# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ELECTROPHILIC SUBSTITUTION AT AN AROMATIC CARBON ATOM

I. P. Beletskaya et al 8 May 1969 9 p refs Transl. into ENGLISH from Zh. Organ. Khimii (USSR), v. 4, no. 4, 1968 p 542-544
(AD-693649; FTD-HT-23-23-69) Avail: CFSTI CSCL 7/3

A study was made of the acid splitting of diphenyl mercury in dimethylformamide under the action of various acid agents and the absence of any connection between the rate of protodemercuration and the strength of the applied acid was shown. It was demonstrated that the protolysis of diphenyl mercury is subject to nucleophilic catalysis by halide ions, and a mechanism is proposed for this reaction which involves participation of a complex of halide ion with diphenyl mercury and an ion pair of the acid agent. The influence of substituents in this reaction is determined by electrophilic attack with respect to the carbon atom. The applicability of the Yukawa-Tsuno equation for the given reaction series was demonstrated. Author (TAB)

N70-11863# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETERMINATION OF MOISTURE CONTENT OF FREON-12 BY INFRARED SPECTROSCOPY

V. S. Pavlova et al 31 Jan. 1969 9 p Transl. into ENGLISH from Kholodil. Tekhn. (Moscow), v. 43, no. 10, 1966 p 25-27
(AD-693442; FTD-HT-23-775-68) Avail: CFSTI CSCL 7/4

A means is given for determining the quantity of water in freon-12 by the method of infrared spectroscopy, based on the measurement of water by infrared radiation. The method allows the determination of water concentration from 0.0003 to 0.0040% with an accuracy of 10% (relative). The analysis of one sample may be completed in 7-10 minutes. Author (TAB)

N70-11898# Maryland Univ., College Park. Inst. for Molecular Physics.

MICROWAVE SPECTRUM OF FLUOROACETONE

Ellen Saegebarth and Lawrence C. Krisher 1969 40 p refs Sponsored by Public Health Serv., Natl. Inst. of Health, and NSF
Avail: CFSTI

The microwave spectrum of fluoroacetone was studied in the region 18-35 GHz, and transitions arising from one rotamer were assigned. This rotamer has all the heavy atoms in a plane with the fluorine and oxygen atoms trans to one another. The rotational constants are A = 8658.06, B = 4021.64, C = 2845.12 MHz, which give I sub a + I sub b - I sub c = 6.406 amu - A squared. Stark effect measurements give the dipole moment components: mu sub a = 0.907 + or - 0.020 D, mu sub b = 0.76 + or- 0.05 D, mu = 1.18 + or - 0.05D. Satellite lines arising from excited states of both the methyl and CH2F torsions have been identified. The splittings of the rotational lines into A and E components were analyzed using as a model a rigid methyl group attached to a rigid framework. Author

N70-11899*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

REACTION OF O(1 D) WITH N2 O

R. I. Greenberg and J. P. Heicklen 15 Nov. 1969 12 p refs
(Grants NGL-39-009-003; NSF GP-5611)
(NASA-CR-106835; SR-343) Avail: CFSTI CSCL 07D

The reaction of O(1D), produced from the photolysis of N2O at 2139 A, reacts with N2O via O(1D) + N2O = N2 + O2, and 2 NO. The method of chemical difference to obtain an accurate measure of K sub 2/k sub 3 = 1.12 + or - 0.02 was used. Furthermore the quantum yield of production of O(3P) either from direct photolysis or deactivation of O(1D) by N2O is less than 0.02 and probably zero. Author

N70-11906*# Southwest Research Inst., San Antonio, Tex.

DEVELOPMENT OF BATTERY SEPARATOR MATERIAL PROCESS Quarterly Report, 2 Jul. - 30 Sep. 1969

L. M. Adams and W. W. Harlowe, Jr. 15 Oct. 1969 36 p Prepared for JPL
(Contracts NAS7-100; JPL-951718; SwRI Proj. 01-2015)
(NASA-CR-106990) Avail: CFSTI CSCL 07C

Increasing the carbon tetrachloride concentration in the 15 weight percent acrylic acid grafting solution from 0 to 15 weight percent has a pronounced effect on the properties of the grafted polyethylene film produced. The degree of grafting decreases from about 1.0 to 0.44. The electrical resistance of the grafted and crosslinked film increases from 11 to 89 milliohm-sq inch before sterilization and from 13 to 274 milliohm-sq inch after sterilization. Similar results were obtained with methacrylic acid except that grafting with methacrylic acid is more sensitive to concentration changes of carbon tetrachloride. Battery separator materials prepared by grafting polyethylene film with acrylic acid-methacrylic acid mixtures and crosslinking with divinylbenzene are quite similar to those prepared from acrylic acid. Data obtained on the effect of concentration of carbon tetrachloride in the grafting solution (15 weight percent acrylic acid) on silver ion migration are somewhat erratic. Author

N70-11909 National Lending Library for Science and Technology, Boston Spa (England).

RELATION BETWEEN ELECTRON STRUCTURE AND POLAROGRAPHIC BEHAVIOUR OF INORGANIC DEPOLARIZERS. PART 4: ELECTRODE PROCESSES IN WHICH (N-2) F ELECTRODES PARTICIPATE [VZTAH MEZI ELEKTRONOVOU STRUKTUROU A POLAROGRAFICKYM CHOVANIM ANORGANICKYCH DEPOLARISATORU. PART 4: ELEKTRODOVE PROCESY, JICHZ SE ZUCASTNUJI (N-2) F ELEKTRONY]

A. A. Vicek Jun. 1969 31 p refs Transl. into ENGLISH from Chem. Listy, v. 8, 1958, p 214-227
(NLL-RTS-5106) Avail: Natl. Lending Library, Boston Spa, Engl.: 35s

A polarographic study of the redox system Eu(+2)/Eu(+3) which behaves irreversibly in most basic electrolytes is discussed. The character and concentration of anions in the basic electrolyte

had a pronounced effect on the position and form of the europium waves. Reversible behavior was found only in ethylene diamine tetraacetic acid. Two reduction mechanisms were assumed to take place simultaneously: (1) The electron is received directly in the orbit of the europium ion. (2) The ligands act as a bridge for electron transfer between the electrode and the central ion. The presence of an excited ion of divalent europium on the electrode was demonstrated. Author

N70-11945# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF INFRARED ABSORPTION SPECTRA OF POLYMERS BASED ON BISPHENOLS AND FORMALDEHYDE DURING THEIR HARDENING AND THERMAL DEGRADATION
L. I. Komarova et al 2 Jun. 1969 6 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii (Minsk), v. 7, no. 4, 1967 p 611–614
(AD-693604; FTD-HT-23-24-69) Avail: CFSTI CSCL 7/4

The IR spectra was used to study the processes occurring in polymers based on 1,6-bis(p-oxyphenyl)hexane, 1,8-bis(p-oxyphenyl) octane, 1,10-bis(p-oxyphenyl) decane, and 1,1-bis(p-oxyphenyl) cyclohexane during their hardening and thermal degradation. Polymer specimens were obtained in the form of films on NaCl plates from a solution in acetone and then were hardened by sequential heating in the temperature interval 70-330 degrees C in a current of nitrogen. The nitrogen significantly reduced the rate of oxidizing processes. Author (TAB)

N70-11961# National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
MICROCHEMICAL ANALYSIS SECTION: SUMMARY OF ACTIVITIES, JULY 1967 TO JUNE 1968
John K. Taylor ed. Oct. 1968 145 p refs
(NBS-TN-455) Avail: SOD $1.25

General activities are reported in the areas of gas analysis, polarography, potentiometry, coulometry, chemical microscopy, and classical microchemical analysis. Research activities described in some detail include: determination of trace amounts of oxygen in gases, development of a coulometric method for precise analysis of boric acid, improvements in microdetermination of silver and fluorine by null point potentiometry, the electrochemical generation of fluoride ion, preparation of resin bead particle standards, and determination of trace elements by the nuclear track technique. A number of microchemical procedures which were developed for the analysis of a variety of materials are also included. Author

N70-11982*# Oklahoma State Univ., Stillwater. School of Chemical Engineering.
INTERACTIONS OF LIKE AND UNLIKE MOLECULES Progress Report, 1 Apr. – 30 Sep. 1969
Robert L. Robinson, Jr. 1 Oct. 1969 38 p refs
(Grant NGL-37-002-011; OER Proj. 3)
(NASA-CR-106987; ER-70-F-4) Avail: CFSTI CSCL 07D

Progress in the gas phase studies include: (1) data on volumetric properties of helium-krypton mixtures have been analyzed to provide second and third virial coefficients for pure and mixed interactions in the region 225 deg to 325 deg K. (2) An apparatus for measurement of solid-gas and vapor-liquid equilibrium from 90 deg K to room temperature has been designed and fabricated. Testing of the apparatus is in progress prior to beginning study of solid-gas equilibria in the helium-krypton system. (3) Calculations have been made which elucidate the effect of experimental variables on the accuracy of pair-potential parameters determined from virial coefficient data. For the liquid phase studies, Barker's quasi-lattice theory was applied to mixing properties of alcohol-paraffin systems, and comparisons with experimental data reveal an accuracy comparable to the lattice-gas model recently developed. Also, a simplified vapor pressure apparatus has proved satisfactory for measurement of binary solution vapor pressures. Data were obtained on binary mixtures of hexane, benzene, and ethanol, and excess free energies and entropies calculated therefrom. Author

N70-11976# California Univ., Berkeley. Lawrence Radiation Lab.
THE HOT-ATOM CHEMISTRY OF LOW ENERGY CARBON IONS IN BENZENE
Helmut Martin Pohlit (Ph.D. Thesis) Jun. 1969 233 p refs
(Contract W-7450-eng-48)
(UCRL-18895) Avail: CFSTI

A 10-kV ion accelerator is described with which C 14 ion beams of 1 to 2 MuA intensity and variable energies between 3 and 15,000 eV (at about 3 eV energy spread) are obtained. The chemistry of these C14 ions with various chemical substances in which they are absorbed can be investigated. At energies above approximately 100 eV the hot-atom chemistry of nucleogenic carbon isotopes can be simulated with this equipment. Below 100 eV, the dependence of the product-yields on the kinetic energy can give valuable information about the mechanisms and kinetics underlying product formation. Methods, and their limitations, employable in this area of chemical experimentation are discussed. The formation of products from fast C14 ions and atoms in solid benzene (– 196 C) were investigated. Yields of seven major products (benzene, toluene, cycloheptatriene, phenylacetylene, biphenyl, disphenylmethane, and phenylcycloheptatriene) were determined as a function of the beam energy. Author (NSA)

N70-11981*# Pennsylvania Univ., Philadelphia. School of Chemical Engineering.
STUDY OF THE ZINC-SILVER OXIDE BATTERY SYSTEM Quarterly Report, Oct. 1969
Leonard Nanis Oct. 1969 13 p Prepared for JPL
(Contracts NAS7-100; JPL-952543)
(NASA-CR-106991) Avail: CFSTI CSCL 07D

Results of a silver oxide electrode investigation are presented including single crystal preparation; anode reactions; thermogravimetric analysis and structural determination of the anode product; chemical stability, leaching, and electrical resistivity of silver peroxynitrate; and equilibrium electrode potential. Transport parameters were also investigated. Work on a permeation apparatus and results of the zinc analysis of battery separator permeability are described. Progress in an electrode diffusivity study is also reported, involving the capillary method, reduction and measurement of capillary dimensions, reduction in flow velocity, and capillary wetting. J.A.M.

N70-11990# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
DISSOLUTION OF IMPURE PLUTONIUM TETRAFLUORIDE IN NITRIC ACID
James D. Navratil 25 Jun. 1969 4 p refs
(Contract AT(29-1)-1106)
(RFP-1118) Avail: CFSTI

Optimum dissolution conditions were found for impure plutonium tetrafluoride (major impurities: PuO2 and MgO). They are nitric acid concentration of 12 to 14 molar, reflux and stirring for up to two hours, solid-to-liquid ratio of 100 to 150 g/l, and addition of boric acid or aluminum nitrate. Author (NSA)

N70-11993# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
DISSOLUTION OF PLUTONIUM TETRAFLUORIDE IN NITRIC ACID
James D. Navratil 25 Jun. 1969 5 p refs
(Contract AT(29-1)-1106)
(RFP-1151) Avail: CFSTI

Optimum conditions for plutonium tetrafluoride dissolution in nitric acid were investigated and found to be solid-to-liquid ratio of 100 to 150 g/l, reflux and stirring for up to 2 hours, nitric acid concentrations of 12 to 14 molar, and addition of boric acid or aluminum nitrate as a fluoride ion complexing agent. Author (NSA)

N70-11996# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESEARCH ON ALKOXYSILANES
M. G. Voronkov 10 Jul. 1969 11 p refs Transl. into ENGLISH from AN Latsar. Izv. Ser. Khim. SSR (Moscow), no. 4, 1967 p 452–562
(Contract F33657-68-D-08651P002)
(AD-693483; FTD-HT-23-1382-68) Avail: CFSTI CSCL 7/3

Physical properties (refraction index, volume and viscosity) change in time and water concentration of tetraethoxysilane aqueous dioxane and alcoholic solutions in the presence of an acid catalyst (HCl) were studied. Maximums on property-time isotherms as well as the water concentration changes indicate that the process of tetraethoxysilane hydrolysis is a complicated one. It consists of a series of successive and simultaneous hydrolysis and condensation reactions (intermolecular dehydration and silanolysis) and cannot be presented throughout its duration as a single stoichiometric equation. The appearance of maximums on the property-time isotherms corresponds to the minimum current concentration of water. The effect of Si(OC2H5)4/H2O ratio, catalyst and temperature on the process of hydrolysis has been established. A possible scheme of hydrolysis reaction mechanism has been suggested. Author (TAB)

N70-12016*# Stanford Research Inst., Menlo Park, Calif.
EFFECT OF ENVIRONMENT ON THERMAL CONTROL COATINGS Final Report
S. R. Morrison and K. M. Sancier 15 Oct. 1969 121 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951522; SRI Proj. Pad-6148)
(NASA-CR-106-996) Avail: CFSTI CSCL 07D

Degradation of thermal control coatings under combined conditions of ultraviolet radiation and vacuum is initiated by the photoproduced holes and electrons, either of which can undergo chemical reaction. Such chemical reactions change the structure of the coating, leading eventually to coloration. In order to prevent optical degradation it is necessary to find surface additives that act as recombination centers, alternately capturing the holes and electrons and thus removing the photoproduced carriers with no net chemical change. For example, single crystal measurements show improvement up to a factor of one million in rate of conductivity degradation, and powder measurements show photodamage protection from 0.01 monolayers of additive. Zinc oxide was the primary material used in the research program. Author

N70-12029# Atomic Energy Commission, New Brunswick, N.J. New Brunswick Lab.
NEW BRUNSWICK LABORATORY Annual Progress Report, Jul. 1967 – Jun. 1968
C. J. Rodden Apr. 1969 78 p refs
(NBL-247) Avail: CFSTI

Progress is reported on the following studies: determination of uranium in product and fuel materials by ferrous reduction in H3PO4 and titration with K2Cr2O7; rapid separation of uranium by reversed-phase chromatography and measurement by titration to a fixed potential after ferrous reduction in H3PO4; behavior of Pt and Au electrodes for controlled potential coulometric determination of Pu; spectrophotometric determination of Zr in Th(NO3)4; fusion of refractory plutonium oxides with NaHSO4; elution behavior of large amounts of uranium from an anion exchange resin column; spectrophotometric determination of S in B and of Ti in B; spark positioner for MS-7 mass spectrograph; effects of variability in electrode dimensions on spectrochemical carrier distillation analyses; spectrochemical determination of impurities in silicone elastomer; determination of impurities in Th(NO3)4 and uranium solutions by atomic absorption spectrophotometry; present and proposed programs for a small general purpose computer at New Brunswick Laboratory; and elemental boron analyzed samples of high-purity (99%) and production grade(95%) boron NSA

N70-12048# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
MOESSBAUER EFFECT IN THE FeS SUB (1 PLUS x) SYSTEM
G. N. Goncharov, Yu. M. Ostanevich, S. B. Tomilov, and L. Cher 1969 21 p refs In RUSSIAN
(JINR-P14-4312) Avail: AEC Depository Libraries

The composition dependence of the Moessbauer effect in the FeS sub (1+x) system is described for 0 < or = to x < or = to 0.135 at room temperature. The changes observed in the velocity spectrum parameters are associated with phase transitions and a change of the concentration of iron vacancies. The observed quadrupole splitting is in good agreement with the estimations from the model of point charges. The presence of Fe (3+) was not detected in the system in the whole investigated composition range. The observed influence of iron vacancies indicates a strong superexchange responsible for the ferromagnetic bond of iron spins in the C plane. The coincidence of the observed phase boundaries with those expected from the consideration of ordering vacancies is noted. Author (NSA)

N70-12073# California Univ., Berkeley. Lawrence Radiation Lab.
METASTABLE IONS IN THE MASS SPECTRA OF MOLECULAR NITROGEN, NITRIC OXIDE, NITROUS OXIDE, AND NITROGEN PEROXIDE
Amos Newton and A. F. Sciamanna May 1969 3 p refs Presented at the 17th Ann. Conf. on Mass Spectrometry and Allied Topics, Dallas, Tex.
(Contract W-7405-eng-48)
(UCRL-18726) Avail: CFSTI

Using a mass spectrometer modified to increase the pumping speed in the analyzer tube, to increase the sensitivity of the dc amplifier, and to accurately measure potentials applied to the metastable suppressor, metastable ions were observed in the mass spectra of N2 and NO. In N2O and NO2, metastable dissociation of N2(+) and NO(+) were also observed. Author (NSA)

N70-12074# Mound Lab., Miamisburg, Ohio.
HYDRIDIC NATURE OF RARE EARTH PREPARATIONS WITH REDUCING PROPERTIES
G. L. Silver, P. W. Seabaugh, W. H. Smith, and R. R. Eckstein 8 Aug. 1969 13 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1648) Avail: CFSTI

The precipitates that result from the dissolution of praseodymium in acetic acid and gadolinium in mucochloric acid contain hydridic hydrogen, as shown by the large fraction of HD in the gas released when the precipitates are decomposed with deuterium chloride. X-ray powder diffraction patterns of the compounds suggest they have the fluorite structure. The infrared spectra of the compounds are not amenable to easy interpretation. Author (NSA)

N70-12082# Michigan Technological Univ., Houghton. Dept of Metallurgical Engineering.
STRUCTURE AND PROPERTIES OF SOLID SOLUTIONS Technical Progress Report, 1 Mar. 1968 – 15 Jun. 1969
A. A. Hendrickson and C. C. Chen 15 Jun. 1969 22 p refs
(Contract AT(11-1)-916)
(COO-916-15; TPR-9) Avail: CFSTI

Research effort on the development of experimental techniques for the measurement of dislocation velocities in silver and silver solid solutions is reported. A modified Czochralski method was used in the growth of low dislocation density, seeded silver crystals at densities as low as 1000/sq cm. High temperature annealing yields crystals with only 100 dislocations per sq cm. A crystal cutting and polishing process consisting of erosion spark cutting and subsequent mechanical and chemical polishing was established to obtain rectangular parallelepiped crystals with strain free (111) surfaces. A magnetic stress pulsing apparatus was designed and

constructed for stressing crystals over small time durations. These techniques are now being applied to study the characteristics of dislocation motion in silver crystals. Author (NSA)

N70-12083# California Univ., Berkeley. Lawrence Radiation Lab.
THE DESIGN OF AN IMPROVED DEVICE FOR ABSORPTION WITH CHEMICAL REACTION
Edward J. Palkot, Jr. (M.S. Thesis) and C. Judson King Jun. 1969 192 p refs
(Contract W-7405-eng-48)
(UCRL-18918) Avail: CFSTI

Examples of absorption systems that were considered in this study are the scrubbing of CO2 from gas streams using hot, catalyzed potassium carbonate and the scrubbing of HCl from gas streams using water. Consideration was given to less commonly used devices that had features likely to result in high absorption rates and, consequently, high efficiency. The devices considered were the co-current packed column, open pipe contractors with co-current flow of gas and liquid in the froth and annular regimes, and the spray tower. On the basis of information dealing with these devices in the literature and models that were proposed to fill gaps in the literature, device sizes necessary to scrub gases of quantities and compositions likely to be encountered in industry were calculated. Hierarchies of attractiveness of the devices for each of the systems studied were determined by assigning relevant cost variables to each contractor. It was found that some of the devices could well be attractive in reducing the costs of absorption in the processes considered. Author (NSA)

N70-12118*# General American Transportation Corp., Niles, Ill. Research Div.
PERFORMANCE TESTS OF AN ORGANIC AMINE CARBON DIOXIDE REMOVAL SYSTEM Summary Report, 24 Jul. 1968 – 29 May 1969
A. J. Glueckert and G. A. Remus 29 May 1969 84 p refs
(Contract NAS1-8360)
(NASA-CR-66847) Avail: CFSTI CSCL 07C

An experimental evaluation was conducted on a regenerable two-bed carbon dioxide removal system which utilized an organic amine sorbent. This sorber formulation absorbs CO2 in the presence of H2O vapor and thus does not require pre-drying the gas stream. The primary objective of the test program was to relate the system performance of CO2 removal rate, power, and water carry-over with CO2 during regeneration to the operating parameters of air-flow rate through the bed, absorption-regeneration time, and bed cooling and heating rates. All other operation conditions were held constant. The Box – Wilson composite design was used in the experiment design, and to generate quadratic equations relating system performance to the operating conditions. Author

N70-12124# Los Alamos Scientific Lab., N. Mex.
SODIUM LEAK STUDIES
John P. Brainard and Donald C. Kirkpatrick 6 Mar. 1969 10 p ref
(Contract W-7405-eng-36)
(LA-4129-MS) Avail: CFSTI

Containment defects that can result in Na leakage are being investigated. Na leakage through stainless steel into air is analyzed. The problems of locating potential defects with He mass spectrometer leak tests are intensified by the fact that they can easily be obscured by water, oil, and surface oxidation. Under these H2 conditions, treatment at high temperature under vacuum or H2 is required for detection. He leaks as large as 0.0001 atm cy cn/sec do not appear to be a problem in Na systems at 400 C. However, He leaks of this size and smaller do appear to be a serious problem at the temperature of 650 C. Author (NSA)

N70-12135# State Univ. of New York at Buffalo. Dept. of Chemistry.
STUDIES IN SOLUTION AND NUCLEAR CHEMISTRY Research Progress Report, 1 Oct. 1968 – 30 Sep. 1969
Jacob A. Marinsky 1 Jul. 1969 266 p refs
(Contract AT(30-1)-2269)
(NYO-2269-13) Avail: CFSTI

Research is reported on: the ion-exchange phenomena; the solution chemistry of the alkali metals, the alkaline earths, and the transition elements in the presence of linear and cross-linked polyelectrolytes; and, theoretical development of polyelectrolyte models for the knowledgeable interpretation of experimental results. Various ion forms of Dowex-50 resin, its polyelectrolyte analog, polystyrene sulfonic acid, polymethacrylic acid, poly-L-glutamic acid, and poly-L-aspartic acid were used to facilitate these objectives. One important result of these studies during the period of this progress report has been the development of computational methods for the quantitative evaluation of stability constants of complex species in macromolecular systems. Special insight with regard to their configurational properties can thus be deduced from these results as well. Results of the determination of the independent fission yields of technetium 101, 104, and 105 isotopes, obtained in the thermal fission of U-235, are reported. Author (NSA)

N70-12144# Texas A&M Univ., College Station. Dept. of Chemical Engineering.
OPTIMAL BOUNDARY CONTROL SIGNAL SYNTHESIS FOR THE BACKFLOW CELL-NETWORK MODEL OF A NONLINEAR HEAT EXCHANGE REACTOR WITH AXIAL MIXING
J. T. Baldwin, R. A. Ruedrich, and L. D. Durbin Aug. 1969 17 p refs
(Contract N00014-68-A-0140)
(AD-693108; THEMIS-TR-16) Avail: CFSTI CSCL 7/1

The backflow cell-network model in state and adjoint variables is employed to obtain estimates of the optimal control and response trajectories for a nonlinear parabolic distributed system. The process under study is that of a heat exchange chemical reactor with axial mixing. The use of feedback control to obtain the priming control trajectory is shown to be a most useful technique. Resetting gradient methods for maximizing the Hamiltonian are shown to be stable and give fast initial convergence. Estimates of the optimal conditions for the continuous system may be obtained by extrapolating the results for an increasing number of cells. Author (TAB)

N70-12182# National Lead Co. of Ohio, Cincinnati.
AUTOMATIC STEAM DISTILLATIONS OF FLUORIDE INTO SMALL VOLUMES
R. F. Bohlander 7 Feb. 1969 17 p refs Presented at 20th Pittsburgh Conf. on Anal. Chem. and Appl. Spectry., Cleveland, 2 – 7 Mar. 1969
(NLCO-1039; CONF-690322-1) Avail: CFSTI

A rapid method was developed to separate fluorides from interfering ions without excessive dilution. A controlled-temperature Willard – Winter type still was combined with a distillate recycle. Fluorides were trapped out of the distillate with thorium, after which the distillate was boiled and the steam reintroduced into the still. In this manner, the fluorides were removed from the samples in 20 minutes and isolated in a form requiring no further preparation prior to the color development. The apparatus developed for this distillation is relatively simple and inexpensive, and the fluorides are separated into less than 20 ml of distillate. Fluoride concentrations of less than 1 micro g/ml can be determined accurately. Electric heating, controlled by a timer makes the operation automatic. Prior to the color development phase, an analyst is required only to add samples and reagents. Author (NSA)

N70-12189# Hamburg Univ. (West Germany). Mathematisch-Naturwissenschaftliche Fakultät.
ON THE ENERGY DEPENDENCE AND THE MECHANISM OF COLLISION REACTIONS OF SLOW-NEGATIVE IONS WITH MOLECULES [UEBER DIE ENERGIEABHAENGIGKEIT UND DEN MECHANISMUS VON REAKTIONEN BE

STOESSEN LANGSAMER NEGATIVER IONEN AUF MOLEKUELE]
Dieter Vogt (Ph.D. Thesis) 1969 71 p refs In GERMAN
Sponsored by Deut. Forsch. Gemeinschaft
Avail: CFSTI

Some ion-molecule and charge exchange reactions were investigated in which slow negative ions take part. The cross sections of the reactions as a function of the primary ion energy and the angular distribution of the secondary ions were measured, from which conclusions could be drawn whether a reaction is compound or stripping. ESRO

N70-12197# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
BURN-UP DETERMINATION OF POWER REACTOR FUEL ELEMENTS BY GAMMA SPECTROMETRY [DETERMINATION PAR SPECTROMETRIE GAMMA DU TAUX D'IRRADIATION DES ELEMENTS COMBUSTIBLES DES REACTEURS DE PUISSANCE]
Michel Robin, Maurice Jastrzeb, Serge Boisliveau, Robert Boyer, and Rene Vidal Aug. 1969 76 p refs In FRENCH; ENGLISH summary
(CEA-R-3863) Avail: CFSTI

This report describes a method for determining by γ spectrometry the burn up and the specific power of fuel elements irradiated in power reactors. The energy spectrum of γ rays emitted by fission products is measured by means of a simple equipment using a sodium iodide detector and a multichannel analyzer. In order to extract from the spectrum a quantity proportional to the burn-up, it is necessary to isolate an activity specific to one emitter, give the same importance to fissions in uranium and plutonium and to take into account the radioactive decay during and after irradiation. One hundred fuel elements were studied and burn-up values obtained by γ spectrometry were compared to results given by chemical analysis. Preliminary measurements show that the accuracy of the results is greatly increased by the use of a germanium detector, due to its good resolution. Author (ESRO)

N70-12202# Junta de Energia Nuclear, Madrid (Spain). Div. of Chemistry.
AN ANALYTICAL STUDY BY GAS LIQUID CHROMATOGRAPHY AND RADIOCHROMATOGRAPHY OF TRITIUM LABELLED LEBAYCID [ESTUDIO ANALITICO DEL PROCESO DE SINTESIS DEL LEBAYCID MARCADO CON TRITIO POR CROMATOGRAFIA GAS LIQUIDO Y RADIOCROMATOGRAFIA]
Ma. del Milagro Perez-Garcia 1969 35 p refs In SPANISH; ENGLISH summary
(JEN-208-DQ/I-71) Avail: CFSTI

The stability and purity of the syntheses products of lebaycid: 0.0 dimethylphosphochlorothionate and 4-methyl-thio-m-cresol were investigated by gas liquid chromstography. The study on (CH3O)2 PSCl I was made in a column of silicone SE-30, Reoplex 400 using a thermal conductivity detector. The 99.4% pure product obtained from the preparative gas chromatograph was found to be stable within the duration of the experiment: seven months. For the 4-methyl-thio-m-cresol, the column used was of Carbowax 20M. The product obtained was 99.5% pure, which was observed to be stable for four months. The (CH3O)2 PSCl labelled by the Wilzbach method, radiochromatographically analyzed with an ionization chamber, was found chemically pure but was radiochemically impure and with a low specific activity. The radiochromatographic analysis of (CH3O) PSCl2 under the same conditions gave satisfactory resulting activities. Author (ESRO)

N70-12203# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
SOLVENT EFFECTS ON ACID-BASE EQUILIBRIA [EFFETS DE SOLVANT SUR LES EQUILIBRES ACIDES-BASES]
Alain Coulombeau Jul. 1969 28 p refs In FRENCH; ENGLISH summary
(CEA-BIB-147) Avail: CFSTI

Solvent effect theories of acid-base equilibria are summarized and a survey of recent work in this area is reported. Author (ESRO)

N70-12215*# Naval Weapons Center Corona Labs., Calif.
INVESTIGATIONS OF BERYLLIUM ANODES IN NONAQUEOUS ELECTROLYTE SOLUTIONS Final Report
Richard E. Panzer Oct. 1969 71 p refs
(NASA Order ER-9085)
(NASA-CR-86272) Avail: CFSTI CSCL 07D

Electrochemical investigations were conducted to find a compatible electrolyte solution for utilization of beryllium as the anode in a reliable and efficient high energy density voltaic cell. Continuing low potentials indicated that some side reaction was reducing the potential far below the thermodynamic potential, -1.85 V, calculated from free energy values. Problems of complexation and chemisorption on Be metal surfaces and poorly dissociated Be(II) species of low solubility hindered much of the investigation. Using an Hg pool electrode, reversibility was studied across a limited concentration range of BeCl2 dissolved in propylene carbonate solutions. The formation of BeO in aqueous solution was verified and also observed in nonaqueous systems. This is likely the result of the disproportionation of a solvo-Be(I) species, probably (Be)2(+2). The disproportionation reaction, resulting in powdery Be metal, and solvo-Be(II) moieties may explain the many unsuccessful efforts to deposit adherent Be coatings. The results of these investigations emphasize the fact that the charge to radius ratio of Be(II) completely dominates the chemistry of this element. Author

N70-12220# Hamburg Univ. (West Germany). Inst. für Anorganische Chemie.
CRYSTAL STRUCTURE INVESTIGATIONS OF SOME SIMPLE AND COMPLEX ACETYLIDES [KRISTALLSTRUKTURUNTERSUCHUNGEN AN EINIGEN EINFACHEN UND KOMPLEXEN ACETYLIDEN]
Heinrich Plass (Ph.D. Thesis) 1968 65 p refs In GERMAN
Avail: CFSTI

The crystal structures of the organometallic acetylides were investigated by means of X-ray diffraction analysis. The diagrams were indexed and the lattice constants determined, and these are presented in tables. The stereochemical structure of these compounds was determined and the atomic coordinates calculated by means of Fourier and Patterson synthesis. ESRO

N70-12251# Hamburg Univ. (West Germany).
CHARACTERIZATION OF THE METAL DERIVATIVES OF O-DIETHYNYL BENZENE [ZUR KENNTNIS DER METALLDERIVATE DES O-DIAETHINYLBENZOLS]
Gerhard Wallenwein (Ph.D. Thesis) 1968 72 p refs In GERMAN
Avail: CFSTI

The bifunctional terminal alkine o-diethynyl benzene exhibits a weakly dibasic acid character in liquid ammonia. Two series of salts are derived from it — monoalkali acids and dialkali acids — which behave like weak electrolytes in liquid ammonia. One of the diethynylide anions together with the transition metals forms complexes with a coordination number of 4. The metal-carbon bond is of a double bond character, and coordination polymers are found with a plane quadratic configuration. The palladium and platinum complexes are relatively stable compared to other transition metal complexes, but the nickel complex is highly unstable. ESRO

N70-12252# Hamburg Univ. (West Germany).
NEIGHBORING-GROUP REACTION, FRAGMENTATION AND ELIMINATION AT VICINAL DI-O-MESYL SUGARS WITH HYDRAZINE: SYNTHESIS AND REACTION OF N-AMINO AZIRIDINE SUGARS, DESOXY-HEXURONIC ACIDS

AND DESOXY-HEXULOSE HYDRAZONES [NACHBARGRUPPENREAKTON, FRAGMENTIERUNG UND ELIMINIERUNG AN VICINALEN DI-O-MESYL-ZUCKERN MIT HYDRAZIN: SYNTHESE UND REAKTIONEN VON N-AMINO-AZIRIDINO-ZUCKERN, DESOXY-HEXURONSAEUREN UND DESOXY-HEXULOSEHYDRAZONEN]

Dieter Stoye (Ph.D. Thesis) 1968 144 p refs In GERMAN
Avail: CFSTI

The reactions of hexofuranoses and hexapyranoses containing vicinal methane sulfonyl groups with hydrazine are discussed. These reactions and the fragmentation of several compounds, the stereochemistry of some isomer hydrazones are investigated, using nuclear magnetic resonance spectroscopy. From the high reaction rate and the uniformity of the reaction products it is concluded that in some reactions in which the hydrazide anion fragmentates, the fragmentation mechanisms are synchronous. ESRO

N70-12271# California Univ., Berkeley. Lawrence Radiation Lab.
CARBON REPLICA PREPARATION FOR ELECTRON MICROSCOPY

Walter T. Giba and Rolf H. Muller May 1969 15 p refs
(Contract W-7405-eng-48)
(UCRL-18818; UC-37) Avail: CFSTI

Detailed procedures are given for the preparation of two step carbon replica of metal surfaces for examination by transmission electron microscopy. The technique employs a plastic replicating film and is particularly suited for metal surfaces resulting from electrochemical dissolution. Author (NSA)

N70-12341# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.
HELIUM PUMPING BY CONDENSED LAYERS OF GAS IN THE PRESSURE INTERVAL 0.000000001 TO 0.0000000000001 TORR

V. B. Yuferov and P. M. Kobzev 1968 9 p refs In RUSSIAN
(FT1-231) Avail: CFSTI

The isotherms of helium sorption by solid layers of condensed gas were previously determined at 4.2 and 2 K at pressures from 10 to the minus 3 to 10 to the minus 9 torr. In the investigation reported here an attempt was made to obtain a pressure of approximately 1 × 10 to minus 13 torr in an unheated system, and to calibrate a magnetron-type manometer in the pressure range from 10 to the minus 5 to 10 to minus 13 torr. The pumping effect of N2 and Ar layers at 10 to the minus 5 to 10 to the minus 13 torr was also investigated. The isotherms of hedium sorption of N2, Ar and CO2 at 10 to the minus 9 to 10 to the minus 13 torr pressures were obtained. The isotherms indicate that the layers are capable of absorbing 5 to 10% of the helium at 10 to the minus 9 to 10 to the minus 13 torr. Author (NSA)

N70-12360# Tennessee Univ., Knoxville. Dept. of Chemistry.
RADIATION-INDUCED ISOMERIZATION OF 1-BROMOBUTANE BY A FREE RADICAL CHAIN REACTION

Donald H. Martin and Ffrancon Williams [1966] 27 p refs
(Contract AT-(40-1)-2968)
(ORO-2968-45) Avail: CFSTI

It is shown that the radioinduced isomerication of 1-bromobutane to 2-bromobutane is an autocatalytic reaction in which hydrogen bromide functions as a chain transfer agent. The reaction was studied as a function of dose, dose rate, temperature, and added hydrogen bromide concentration. Free radical scavengers (DPPH and iodine) inhibit the chain reaction. The presence of hydrogen bromide is essential to chain propagation and experiments with tritiated HBr show that the tritium atom is transferred from TBr to give both 2-bromobutane and 1-bromobutane as radioactive products. In the absence of added hydrogen bromide, the concentration of butenes and HBr each attains a stationary value of ca. 5 × 10 to the minus 4M at very low doses. The butene products include cis- and trans--2-butene in addition to 1-butene. A mechanism is proposed whereby bromoalkyl radicals undergo rearrangement through steps that involve elimination of a bromine atom, olefin isomerization, and re-addition of Br. Author (NSA)

N70-12365# Junta de Energia Nuclear, Madrid (Spain). Materials Div.
DISSOLUTION OF ALUMINUM [DISOLUCION DE ALUMINIO]

A. Uriarte Hueda, M. Berberana Eizmendi, and G. Pereira Sanchez 1968 21 p In SPANISH; ENGLISH summary
(JEN-203-DMa/I-23) Avail: CFSTI

The dissolution of aluminum with acid solutions (nitric acid – mercuric nitrate) and alkaline solutions (sodium hydroxide – sodium nitrate) has been studied. The Instantaneous Dissolution Rate (IDR) was determined in function of the concentration of the reagents used and the dissolution temperature. The second part of the report covers a series of experiments on complete dissolution of aluminum showing total dissolution time, reagent consumption and stability of resultant solutions. Author (ESRO)

N70-12370# Union Carbide Corp., Oak Ridge, Tenn. Gaseous Diffusion Plant.
PERMSELECTIVE MEMBRANE CASCADES FOR THE SEPARATION OF XENON AND KRYPTON FROM ARGON

S. Blumkin 1969 13 p refs
(Contract W-7405-eng-26)
(K-OA-1622-Rev-1) Avail: CFSTI

It is estimated that a capital investment of $366,000 is required to construct a dimethyl silicone membrane cascade designed to process 10 scfm of radioactive mixture argon containing fission product xenon and krypton present at the level of 567 curies per scf. The stream depleted in xenon and krypton from this cascade has an activity less than 0.03 curies per scf and can be withdrawn at the rate of 9.98 scfm. Thus, the gas concentrated in fission products can be collected for storage at the rate of 0.02 scfm. For larger collection rates, cascade size and cost can be reduced: if the gas storage rates are 0.1 and 1.0 scfm the cascade capital cost estimates are $342,000 and $289,000, respectively. These results should be regarded as preliminary and no more than a presentation of the potential applicability of the membrane to the desired separations. Assumptions such as those associated with cascade designs have appreciable uncertainties in them. The membrane cost used is a projection by the manufacturer to some future mass production level. Author (NSA)

N70-12389# California Univ., Los Angeles. Dept. of Chemistry.
CONSERVATION OF SPIN DIRECTION AND PRODUCTION OF SPIN ALIGNMENT IN TRIPLET-TRIPLET ENERGY TRANSFER

M. A. El-Sayed, D. S. Trinti, and E. M. Yee Sep. 1969 7 p refs
(Contract N00014-67-C-0111)
(AD-693211; TR-3) Avail: CFSTI CSCL 7/5

The communication gives experimental results on the conservation of the spin direction in T-T energy transfer, and to point out that the latter process could be used to prepare triplet molecules of the acceptor in a state of spin alignment or spin polarization (i.e., with the populations of the three z.f. levels unequal). Author (TAB)

N70-12390# Stanford Univ., Calif. Dept. of Materials Science.
USE OF SOLID STATE ELECTROCHEMICAL TRANSDUCER TECHNIQUES FOR CONTROL OF THE POINT DEFECT STRUCTURE IN SOLIDS Final Technical Report, 1 Apr. 1967 - 31 Mar. 1969

M. S. Whittingham, R. W. Helliwell, and R. A. Huggins Jun. 1969 89 p refs
(Contract N00014-67-A-0112)
(AD-693158; SU-MDS-69-R-64) Avail: CFSTI CSCL 20/12

Studies of the crystal structure and ionic transport in materials containing beta alumina and related phases are reported. Beta alumina has the nominal formula MAl11O17, where M is Li, Na, K, NH4, Ag, or Tl. The structure of the adjacent M2O-rich phase

was studied and found to have an analogous structure consisting of dense blocks with the gamma alumina structure separated by low-density bridging layers containing M ions. Unusually rapid ionic transport along these bridging layers was found, and defect models appropriate to such systems discussed. Author (TAB)

N70-12401# New York Univ., N.Y. Dept. of Chemistry.
PHOTOEMISSION BY SOLUTIONS
Bill Baron, Pierre Chartier, Paul Delanay, and Roberto Lugo Apr. 1969 37 p refs Submitted for publication
(Contract Nonr-285(85))
(AD-693155; TR-11) Avail: CFSTI CSCL 7/4

A detailed experimental study is reported of electron photoemission at a solution-nitrogen interface by aqueous solutions of potassium or sodium ferrocyanide. Old work on this problem is briefly reviewed as well as similar studies with organic systems and alkali metals in liquid ammonia. The following topics are covered: Outline of experimental methods; variations of collected current with field strength and gas pressure; dependence of electron drift velocity in gases on field strength and pressure; plot of the reciprocal of current against the reciprocal of electron drift velocity; application of this plot to the determination of the emitted current and the average velocity and energy of electrons at emission; dependence of emitted current on field strength and possible explanations based on the photoelectric Schottky effect and/or field penetration in solution; correlation with double layer structure; spectral response for the collected current and determination of the threshold at 236 millimicrons for 0.1 M K4Fe(CN)6; correlation with absorption band for charge transfer to solvent; influence of ionic valence and spectral shift. Author (TAB)

N70-12403# California Univ., Los Angeles. Dept. of Chemistry.
NEW SPECTROSCOPIC TECHNIQUES FOR STUDYING THE ORIGIN OF MOLECULAR PHOSPHORESCENCE
D. S. Tinti and M. A. El-Sayed Aug. 1969 17 p refs
(Contract N00014-67-C-0111-0020)
(AD-693210; TR-2; Rept-2455) Avail: CFSTI CSCL 7/5

New indirect techniques are discussed by which one can assign the zero-field level(s) from which the emission of vibronic bands in the spectrum originates. These methods are based on changing the relative populations of the zero-field levels and observing the corresponding changes in the relative intensity of the different vibronic bands at temperatures for which the electron spin-lattice relaxation processes between the zero-field levels are slower than or comparable to the radiative processes. These methods are applied to 2,3-dichloroquinoxaline. A summary of the interpretation of the results obtained and their correlation with theory is given in this paper, but the details of the work are not given. Author (TAB)

N70-12407# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.
POINT SCATTERING THEORY OF X-RAY K ABSORPTION FINE STRUCTURE
D. E. Sayers, F. W. Lytle, and E. A. Stern (Washington Univ., Seattle) Jul. 1969 27 p refs Presented at the 18th Denver X-Ray Conf., Denver, 8 Aug. 1969 Prepared in cooperation with Washington Univ., Seattle
(AD-693193; D1-82-0880) Avail: CFSTI CSCL

The extended x-ray absorption fine structure is calculated by treating the ejected photoelectron as a spherical wave which expands in the lattice and is partially scattered by neighbors of the absorbing atom. The neighboring atoms are treated as point scatterers and the total scattered wave is summed from the waves scattered by each atom. The fine structure is determined from the dipole transition matrix between the initial K-state and the final photoelectron state. Calculations compare favorably with experimental data. Author (TAB)

N70-12410# Aerospace Corp.l El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
ON THE SYNTHESIS OF ReF7 AND THE EXISTENCE OF REF2 AND REF3
R. L. Johnson and B. Siegel 15 Aug. 1969 19 p refs
(Contract F04701-69-C-0066)
(AD-693129; TR-0066(5240-10)-7; TR-0200(4240-10)-12; SAMSO-TR-69-276) Avail: CFSTI CSCL 7/2

The metal explosion technique can be used to synthesize a number of rhenium fluorides, including several that have not been reported previously. Under certain reaction conditions, one can obtain mixtures of the volatile fluorides ReF7 and ReF6. Under other conditions, one can prepare ReF7 free of ReF6. These volatile fluorides are products of Re - SF6 reactions. They are accompanied by the formation of nonvolatile rhenium fluoride films, which are soluble in aqueous NaOH solutions. A rhenium trifluoride is formed at high levels of imparted electrical energy, whereas a tetrafluoride forms at low energy levels. Rhenium explosions in PF5 produced a rhenium difluoride, which is also readily soluble in aqueous NaOH solutions and therefore can readily be separated from unreacted Re powder with which it is admixed on the reactor wall. The difluoride can also be scraped from the reactor wall, but the ReF2 recovered in this way is admixed with a much larger quantity of unreacted metal powder. Author (TAB)

N70-12418# Michigan State Univ., East Lansing.
PHYSICAL MECHANISMS IN THE INACTIVATION OF PROTEINS BY RADIATION
[1969] 17 p
(Contract AT(11-1)-1155)
(TID-25133) Avail: CFSTI

The goal of this program is to understand the molecular processes in proteins that are initiated by radiation and result in inactivation. This objective is being pursued by carrying out biochemical and solid-state studies on enzymes irradiated in solutions and in dry preparations. Much of the work has involved a comparison of the effects of UV and ionizing radiation on such systems. The basis for this work is the hypothesis that inactivation occurs when a sufficient amount of the absorbed energy becomes localized in a cluster of disulfide and hydrogen bonds that are crucial to the maintenance of the unique topography of the active site. Using 2537 A light the involvement of cystine and hydrogen bonds in the inactivation procedure was shown. However, such a wavelength was chosen as the most favorable to show this effect. NSA

N70-12420# National Lead Co. of Ohio, Cincinnati.
SIMULTANEOUS AUTOMATIC DETERMINATION OF URANIUM, ACID NORMALITY, IRON, AND AMMONIA IN PURIFIED URANYL NITRATE SOLUTIONS
J. R. Prall 8 Apr. 1969 16 p refs Presented at the Technicon Intern. Congr. on Automated Anal., Chicago, 4 – 6 Jun. 1969
(Contract AT(30-1)-1158)
(NLCO-1041; CONF-690611-1) Avail: CFSTI

The method proved quite satisfactory for process control and could be easily modified for continuous, in-stream analysis. Analytical data are obtained within 5 minutes after the product is sampled. Uranium is determined by a direct colorimetric procedure. The uranyl nitrate solution is diluted with 1N HNO3, and the absorbance is measured at 408 millimicrons. Acid normality is determined by mixing the sample with a solution of 350 g/l (NH4)2SO4 and measuring the pH with a Beckman combination pH electrode. Acid concentration is then read from a standard graph. Iron is determined colorimetrically using 1,10-phenanthroline as the chromogenic reagent and sodium formate, formic acid as a buffer. The absorbance is measured at 520 millimicrons. Ammonia is determined by a method based on the blue idophenol color that forms when ammonia reacts with sodium phenate in the presence of sodium hypochlorite. The uranium present in the sample is complexed with sodium carbonate to prevent its precipitation. Sodium nitroprusside is added as a catalyst. The absorbance is measured at 607 millimicrons. Author (NSA)

N70-12459# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.

INVESTIGATION OF THE CRYOSORPTION PUMPING OF HELIUM, HYDROGEN, AND DEUTERIUM BY CONDENSED GAS LAYERS

V. B. Yuferov, P. M. Kobzev, and Yu. V. Kholod 1968 25 p refs

(NP-17956) Avail: AEC Depository Libraries

An investigation was made of helium sorption on the sorbent gas layers in H2, Ne, CH4, N2, O2, Xe, Kr, Ar, and CO2 in the temperature range 2 to 4.2 K and hydrogen and deuterium sorption on layers of N2, Xe, Ar, and CO2 at 20, 14, and 4.2 K. Sorption isotherms and isosters were obtained and specific pumping speeds were determined. The possibilities for development of the cryosorption pump that can operate in a wide pressure range pumping oilless vacuum systems are discussed. NSA

N70-12469# Houston Univ., Tex. Information and Control Sciences Center.

CHESS: CHEMICAL ENGINEERING SIMULATION SYSTEM. USER'S GUIDE

Rodolphe L. Motard, H. M. Lee, and R. W. Barkley Aug. 1969 126 p refs

(Contract N00014-68-A-0151)

(AD-693522; THEMIS-RE-9-69) Avail: CFSTI CSCL 7/1

The document is a manual for the user of a computer simulation for chemical process plants. Convenient input structure and automatic generation of thermo-physical data for up to 62 standard petrochemical species are given. Other species are handled ad hoc. Process networks consisting of absorption, distillation, reactor, heat exchanger, pumps compressors, mising and splitting elements may be easily structured and the energy and material balances computed for cyclic networks. Author (TAB)

N70-12472# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.

APPLICATION OF RESISTIVITY MEASUREMENTS TO THE CONTROL OF PROTEIN ELUTIONS USING CELLULOSE ION EXCHANGERS [APPLICATION DE LA MESURE DE RESISTIVITE AU CONTROLE D'UNE ELUTION DE PROTEINES A PARTIR DE CELLULOSES ECHANGEUSES D'IONS]

Anne-Marie Duplaa and Gérard Brandolin Aug. 1969 20 p refs In FRENCH; ENGLISH summary

(CEA-R-3824) Avail: CFSTI

The eluate obtained by chromatography of a mixture of proteins on columns of cellulose ion-exchangers (DEAE-cellulose and CM-cellulose) sometimes have very low protein concentrations. The resistivity measurement gives more information than the UV control which is often inadequate. The modifications undergone by elution buffers are recorded and the best conditions for the extraction of an enzymatic protein are determined. The tests are performed without proteins on the columns and consist in a double control of resistivity and pH of elution buffers after they pass onto the exchanger columns. Author (ESRO)

N70-12474# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Chemistry.

THE CO/CO2 AND CO ELECTRODES IN MOLTEN CARBONATES

P. K. Lorentz and G. J. Janz Sep. 1969 31 p refs

(Contract N00014-67-A-0117-0006)

(AD-693136; RPI-441 38; TR-2) Avail: CFSTI CSCL 7/4

The potentials of cells Au/CO,CO2/ CO3(-2)/CO2, O2/Pt and Au/CO/ CO3(-2)/CO2,O2/Pt have been determined in the ternary eutectic Li2CO3 - K2CO3 between 510 and 800C. At 800C the potential resulting from the Au/CO,CO2/ CO3(-2)/CO2,O2/Pt cell indicated that the reaction occurring at the Au electrode was CO3(-2) + CO - 2e = 2CO2. At 700C and lower, the cell potential confirmed that the reaction CO3(-2) + C - 2e = CO2 + CO dominates the high CO partial pressure range. At lower temperatures the reaction CO + 2OH(-) = CO3(-2) + H2 was observed to proceed to the right, consuming part of the incoming CO stream so that the cell potential appeared to deviate from the Nernst slope (corresponding to the reaction CO3(-2) + CO - 2e = 2CO2). The Nernst slopes and cell potentials follow the thermodynamic prediction for the electrochemical reactions occurring at the Au electrode. At low CO flow rates over the entire temperature range, and at all flow rates at higher temperatures the cell potential differed considerably from the predictions for the above reaction. The reaction CO3(-2) + 2H2 - 2e = CO + 2H2O is seen as a possible explanation for this behavior. Author (TAB)

N70-12497# Delaware Univ., Newark. Dept. of Chemistry.

STUDIES ON PRIMARY PROCESSES IN THE RADIATION CHEMISTRY OF LIQUIDS AND ON THE MECHANISM OF THE INTERACTION OF RADIATION WITH BIOLOGICALLY IMPORTANT CHEMICAL SYSTEMS Progress Report, 8 May 1968 - 1 Jun. 1969

Conrad N. Trumbore 1 Jun. 1969 19 p refs

(Contract AT-(30-1)-3383)

(NYO-3383-16) Avail: CFSTI

Experimental evidence is cited that is said to challenge the spur model in aqueous radiation chemistry. The aqueous p-nitrosodimethylaniline (RNO) system is shown to exhibit several different kinds of anomalies in its radiation and photochemistry. Electron spin resonance studies are described, which indicate that OH radical attack on RNO is probably on the ring. A method is described for analyzing the radiolytic product dependence on concentration for binary systems. Computer calculations on pulse radiolysis data and mechanisms are described in which the importance is stressed of initial yields of H3O(+) from the spur on hydrated electron decay. Unexpected pH values were calculated immediately after the pulse in pulse radiolysis or during the irradiation in steady-state radiolysis. Studies are also reported in which there was found an unusually wide variation in radiation sensitivity of various species of blue green algae. Some species are more radiation resistant than M. radiodurans. Author (NSA)

N70-12505# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SYNTHESIS OF SEVERAL AROXYARYLTHIOSILANES

A. M. Kuliev et al 9 Jun. 1969 4 p refs Transl. into ENGLISH from Azerb Khim. Zh. (Baku), no. 6, 1967 p 57 - 59

(AD-693608; FTD-HT-23-104-69) Avail: CFSTI CSCL 7/3

Eight mixed esters of orthosilicic acid of the aroxyarylthiosilane type were synthesized because of the broad application of other silicon esters and the relatively limited information available for this type of structure, including silicon-oxygen and silicon-sulfur bonds. Diphenoxydi(p-tolylthio)silane (II) was prepared by reaction of p-thiocresol with metallic Na in dry benzene at 75-80 C and addition of diphenoxydichlorosilane to the formed p-methylthiophenolate. Additional heating at 80-85 C gave II, which was separated by filtration, evaporation of solvent and vacuum distillation. The other aroxyarylthiosilanes were similarly formed, i.e., diphenoxydi(o-tolylthio)silane, triphenoxy-(o-tolylthio)silane, triphenoxy-(p-tolylthio)-silane, di-(o-cresoxy)-di-(o-tolylthio)silane, di(o-cresoxy)-di-(p-tolylthio)silane, tri-(o-cresoxy)-p-tolylthiosilane), and tri-(o-cresoxy)-(o-tolylthio)silane. The molecular refraction of the compounds and elemental composition were determined. These compounds represent colorless liquids and are soluble in various organic solvents. They decompose slowly in the presence of humidity and have good thermal stability. Author (TAB)

N70-12562# Hamburg Univ. (West Germany).

APPLICATION OF NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY TO THE INVESTIGATION OF THE CHEMICAL ASSOCIATION OF SOLUTIONS OF STRONGLY AFFINITIVE MOLECULES (PHENOLS, AMIDES, AND PHENOL-AMIDE MIXTURES) [ANWENDUNG DER MAGNETISCHEN KERNRESONANZSPEKTROSKOPIE AUF DIE UNTERSUCHUNG DER ASSOZIATION VON

LOESUNGEN STARK ASSOZIIERENDER MOLEKUELE (PHENOL, AMIDE UND PHENOL-AMID-MISCHUNGEN)
Jürgen Ahlf (Ph.D. Thesis) 1967 80 p refs In GERMAN
Avail: CFSTI

The association of molecules via hydrogen bonds is studied for some selected systems (phenol and several amides) by means of nuclear magnetic resonance spectroscopy. The calculation of the equilibrium constants, e.g. of the enthalpy and entropy of formation of association complexes is demonstrated, based on measurements of the chemical shift of the resonances versus temperature and concentration. It was possible to explain the associations by adopting suitable models. ESRO

N70-12606# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
INFRARED DOUBLE RESONANCE IN SULFUR HEXAFLUORIDE
J. I. Steinfeld, I. Burak, D. G. Sutton, and A. V. Nowak [1969] 47 p refs Sponsored by NSF and NATO
Avail: Issuing Activity

The relaxation of sulfur hexafluoride has been monitored by observation of infrared absorption intensities following passage of an infrared laser pulse through the gas. The laser pulse saturates a small number of rotational lines in the transition of SF6 at 944/cm, producing a transient hole in the absorption spectrum at that frequency. This hole is filled in very rapidly by rotational relaxation processes. The specific vibrational excitation is, at essentially the same time, transformed into a vibrational temperature in excess of the gas's translational temperature, by means of very efficient vibration - vibration energy transfer collisions. The energy released in this step also heats the gas translationally by the order of 25 K. A transient absorption spectrum arising from the vibrationally hot SF6 is also given. The slowest relaxation observed in the system is the bulk cooling of the translational temperature of the gas, which occurs in the order of milliseconds under typical experimental conditions. The dominant mechanism for this relaxation appears to be cooling by thermal conduction. Author

N70-12627*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
METHOD AND APPARATUS FOR STABLE SILICON DIOXIDE LAYERS ON SILICON GROWN IN SILICON NITRIDE AMBIENT Patent Application
Ronald A. Cohen and Roy K. Wheeler, inventors (to NASA) Filed 9 Sep. 1969 10 p
(NASA-Case-ERC-10073; US-Patent-Appl-NO-856253) Avail: CFSTI CSCL 07D

A method and apparatus for thermally growing stable silicon dioxide on silicon is disclosed. A silicon nitride tube placed in a furnace is used to grow the silicon dioxide. First, pure oxygen is allowed to flow through the tube to initially coat the inside of the tube with a thin layer of silicon dioxide. After the tube is coated with a thin layer of silicon dioxide, the silicon is oxidized thermally in a normal fashion. The silicon nitride tube can also be used as the ambient for the pyrolytic decomposition of silane and ammonia to form thin layers of clean silicon nitride. The invention can be used to fabricate electronic components used in the space program. NASA

N70-12646# Los Alamos Scientific Lab., N. Mex.
THE SOLUBILITIES OF SELECTED ELEMENTS IN LIQUID PLUTONIUM. PART 14: NIOBIUM IN GALLIUM-PLUTONIUM ALLOYS
D. F. Bowersox 25 Feb. 1969 6 p refs
(Contract W-7405-eng-36)
(LA-4078) Avail: CFSTI

The solubility of niobium in gallium-plutonium alloys containing 0 to 10 at. % gallium was measured over the temperature range 700 to 1000 C. The solubility decreased as the gallium concentration increased. For example, at 850 C the solubility decreased from 2.05 at. % niobium in liquid plutonium to 1.75 at. % niobium in 9.6 at. % gallium alloy. Author (NSA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N70-11413# Washington Univ., Seattle. Dept. of Electrical Engineering.
RELATIVISTIC COMMUNICATIONS EFFECT ASSOCIATED WITH MOVING SPACE ANTENNAS
James Fred Holmes and Akira Ishimaru Apr. 1969 31 p refs
(Contract F19628-68-C-0126)
(AD-692757; SR-2; TR-132; AFCRL-69-0176) Avail: CFSTI CSCL 9/5

Future space missions may require vehicles traveling at relativistic velocities. Consequently, relativistic effects will have to be considered in the development of future space communication systems. This paper presents a formulation of these relativistic communication effects which are not normally encountered by the designer. The gain function, power density available at the receiver and apparent frequency of the source can be greatly affected by the motion of the space craft antenna. In addition, the apparent direction of the spacecraft can be quite different from its actual direction for both the transmitting and receiving conditions. Formulations are presented by which these effects are described for an arbitrary antenna in terms of the antenna characteristics in its rest frame and the actual spacecraft location, a form that is convenient for the designer. In addition, numerical examples are shown to illustrate the magnitude of these relativistic effects. Author (TAB)

N70-11454# Naval Postgraduate School, Monterey, Calif. Dept. of Electrical Engineering.
ANTENNA AND STABILIZATION CONSOLE FOR A VLF RELATIVE NAVIGATIONAL SYSTEM
Bernard Franklin Roeder, Jr. (M.S. Thesis) Apr. 1969 71 p refs
(AD-693098) Avail: CFSTI CSCL 17/7

A VLF relative navigational system makes use of the fact that, at any given point on the earth, phase delay of a received VLF signal is highly stable and predictable. As the receiver is physically moved, phase delay changes linearly with distance from the transmitting station, so that by keeping track of the phase delay of the received signal from several VLF stations, an accurate plot of geographical position is maintained. The paper outlines the development of a relatively simple antenna system, composed of two crossed loops and a whip sense antenna to produce a cardiod shaped radiation pattern, which effectively discriminates against the long-way-around-the world contamination on the short path signal. A means is also devised for electronically rotating the fixed antenna by means of a goniometer which may be stabilized in azimuth by an input from a ships gyrocompass. Author (TAB)

N70-11459# Naval Research Lab., Washington, D.C.
A REVIEW OF RADAR SEA ECHO
Merrill I. Skolnik Jul. 1969 71 p refs
(AD-693452; NRL-MR-2025) Avail: CFSTI CSCL 17/9

This report briefly reviews the ocean surface characteristics that affect radar echo and summarizes the present status of knowledge of the sea echo as a function of radar grazing angle, sea state and wind, polarization, frequency and other factors. The attempts made in the past to provide theoretical models describing the sea echo are reviewed and lead up to the presently accepted models of scattering surfaces composed of the larger gravity waves on which are superimposed the smaller capillary waves. The influence of sea echo on radar design is discussed and is considerably

different than the usual design restraints imposed by thermal noise. The potential application of radar for oceanographic measurements such as sea state and wind is described. Author (TAB)

N70-11472# Army Electronics Command, Fort Monmouth, N.J.
WORD INTELLIGIBILITY OF SPEECH PROCESSED BY TIME DIVISION MULTIPLEXING/PCM COMMUNICATION SYSTEM
Bernard J. Keigher, Peter Zakanycz, and Robert L. Elzner Jul. 1969 33 p refs
(AD-693250; ECOM-3151) Avail: CFSTI CSCL 17/2

During the development of the US Armys PCM multiplex equipment, testing was accomplished on a back-to-back basis. Questions arose as to the telephone circuit quality of various system configurations for equipment deployed in the field or located in the laboratory. The Fairbanks Rhyme Test was used to determine the telephone circuit quality in percent intelligibility and thus a basis was provided to compare the systems. In addition, quantitative electrical measurements of signal-to-quantizing-noise ratio, signal-to-noise ratio and output level were made on the various system configurations to determine system performance. The laboratory system provided slightly higher quality speech intelligibility than the field-deployed system. Based on the results, however, field systems can be simulated in the laboratory to determine performance in the field. Author (TAB)

N70-11482*# Radio Corp. of America, Moorestown, N.J. Defense Electronic Products.
EVALUATION OF A LOW SIDELOBE PHASED ARRAY ANTENNA
Charles E. Profera, Jr. Washington NASA Nov. 1969 63 p refs
(Contract NAS12-149)
(NASA-CR-1471) Avail: CFSTI CSCL 09E

The radiation characteristics of a phased array antenna consisting of low-sidelobe line source elements combined through a dual mode linear power combiner have been determined as a function of both frequency and scan angle. Antenna pattern contour data obtained from a Ku-band experimental array model indicates very low sidelobe power content resulting in extremely high beam efficiency. Single plane scanning to + or − 60 deg has been accomplished with no visible grating lobe formation or array resonance effects. Author

N70-11533# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.
LASER COMMUNICATIONS FOR THE ALOHA SYSTEM
Earl Kanehira May 1969 22 p refs
(Contract F44620-69-C-0030)
(AD-693623; AFOSR-69-2028TR; B69-1) Avail: CFSTI CSCL 17/2

In the laser communication system designed for data transmission and reception, the information carrying binary pulse train is used to activate (forward bias) and deactivate (reverse bias) a light emitting diode. When activated, the light emitting diode emits near-infrared light, and when deactivated, nothing is emitted. The receiver then detects the presence or absence of the near infrared radiation, using a light sensing diode. In the presence of light, the light sensing diode produces a large photocurrent, and in the absence of light, it produces a small current. Any data terminal that can produce and accept binary information can be used directly in a laser communications system without any interface problems between the terminal and the transmitter or receiver. Author (TAB)

N70-11534# Massachusetts Inst. of Tech., Cambridge. Cambridge Research Lab. of Electronics.
SPEECH COMMUNICATION RESEARCH Final Report, 1 Jan. 1966 - 31 Dec. 1968
Kenneth N. Stevens Jun. 1969 41 p refs
(Contract AF-19(628)-5661)
(AD-693554; AFCRL-69-0285) Avail: CFSTI CSCL 17/2

The report summarizes research on speech generation, speech analysis, and speech perception. The work on speech analysis and production includes study of airflow measurements during speech production, cineradiographic observations of the speech mechanism, acoustic analysis of constant and vowel sounds in various contexts, and acoustic studies of the utterances of children at various stages in language development. Research on speech perception included experiments on the identification and discrimination of vowels, analysis of consonant confusions in short-term memory, the perception of dichotically alternated clicks, visual perception of speech stimuli, and perception of certain consonant-vowel utterances by children. Activities also involved the development of a flexible facility for speech research, consisting of a medium-sized general-purpose digital computer and a number of peripheral components. Author (TAB)

N70-11579# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HOW TO RIG A SINGLE-TRANSISTOR RECEIVER FOR BETTER SOUND
Pao-Pen Feng 16 Jun. 1969 8 p Transl. into ENGLISH from Wu Hsien Tien (Mainland China), v. 21, no. 9, 1965 p 26
(AD-693391; FTD-HT-23-1012-68) Avail: CFSTI CSCL 17/2.1

This paper introduces a full wave rectifier circuit which may enable a single-transistor receiver to increase its sound volume substantially. Some details are given with regard to the layout of the circuit and its working principles. This paper also gives suggestions on the ways and means to adjust the radio receiver according to actual receiving conditions. According to this paper, a radio receiver of this type is able to receive broadcasts within 10 - 15 km of the broadcasting station without using any antenna or ground wire. Three technical drawings are given. TAB

N70-11592# Rome Air Development Center, Griffiss AFB, N.Y.
HISTOGRAM BEARING ANALYZER Technical Report, Sep. 1967 - Apr. 1969
Vincent J. Nardozza Jul. 1969 61 p
(AD-693571; RADC-TR-69-262; D1-68-1) CSCL 17/3

The Experimental Model Radio Direction Finding (RDF) Histogram-Time Averaging Processing System (Histogram Bearing Analyzer) and the data collection program conducted to determine its performance characteristics are described. Data comparing the capability of the Histogram Bearing Analyzer with a more conventional HF/DF readout system are presented. Recommendations for improvements in the models performance are continued experimentation are suggested. Author (TAB)

N70-11629# Air Force Cambridge Research Labs., Bedford, Mass.
PROPAGATION THROUGH A RANDOM MEDIUM AND ITS EFFECTS ON ANTENNAS THAT MAXIMIZE INFORMATION TRANSFER
Charles J. Drane, Jr. Jul. 1969 63 p refs *Its* Phys. Sci. Res. Paper No. 389
(AD-693588; AFCRL-69-0299) Avail: CFSTI CSCL 9/4

Statistical communication theory has been applied to the problem of the analysis and optimization of controlled systems that process electromagnetic fields of an information-carrying nature. Maximum information transfer is the objective, which is achieved by a maximization of the transcorrelation function (a space-time average of the correlation between input and output signals of the communications system) relative to various parameters of the system. These techniques have been used in the optimization of the amplitude and phase taper of a receiving array that is part of a communications link in which a fluctuating medium intervenes between transmitter and receiver. The relationship between the transcorrelation function and these antenna parameters has been established. It is the specific purpose of this paper to establish in turn the relationship between the transcorrelation function and the statistical properties of the constitutive parameters of the medium that generally lead to a decorrelation of the transmitted signal. Author (TAB)

N70-11661*# Bellcomm, Inc., Washington, D.C.
DIGITAL FILTERING FOR OPTIMIZATION OF SIGNALS SUBMERGED IN NOISE
S. Y. Lee 7 Oct. 1969 30 p refs
(Contract NASw-417)
(NASA-CR-106917; TM-69-1033-2) Avail: CFSTI CSCL 17B

Photographic noise reduces the amount of image information that can be recorded. Using the two-dimensional Wiener-Hopf equation optimum linear filters for performing a spatial filtering operation on inputs are derived, where the input consists of signal plus white additive noise which have been recorded in a digital array as intensity values. As an illustrative example, four spatial correction filters were constructed from the modulation transfer function of Lunar Orbiter 3. These filters have been used on a representative pictire taken by Lunar Orbiter 3. Author

N70-11678# Ohio State Univ., Columbus. Electroscience Lab.
ARBITRARY INCIDENCE BACKSCATTERING FROM THIN-WALL DIELECTRIC TUBES HAVING FINITE LENGTH
R. E. Van Doeren 1 Aug. 1969 53 p ref
(Contract N00019-69-C-0325)
(AD-693633; Rept-2767-1) Avail: CFSTI CSCL 17/9

An integral equation is given for the electromagnetic field in a dielectric body. The equation is set up for numerical solution for the case of a thin-wall cylindrical shell having finite length. The solution of the integral equation utilizes a truncated Fourier expansion of the field in the shell. The integral equation is enforced at discrete points in the dielectric shell to obtain a system of linear equations in the unknown expansion coefficients. Numerical integration through the shell volume yields the coefficients in the system of linear equations. The system of equations is solved numerically for the expansion coefficients. Calculation of the backscattered fields and the backscattering cross section are then performed. Calculated results are presented for plane wave backscattering from thin-wall cylindrical shells for oblique incidence. The theoretical results show excellent agreement with experimental data for the TE and TM cases. Author (TAB)

N70-11712# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
EXPERIMENTATION AND ANALYSIS OF SITING CRITERIA Final Report
George F. Spingler Sep. 1969 156 p refs
(AD-693541; NA-69-36; RD-69-43) Avail: CFSTI CSCL 17/7

The purpose of the project was to determine, through test and analysis, siting criteria for new radar beacon sites and to provide methods of eliminating or reducing reflected radar beacon replies at existing field sites. This report conveys (1) the precautions dictated by theory to be observed in siting a new radar beacon site, and (2) various methods of controlling reflecting surfaces to reduce the range of reflected radar beacon signals. Author (TAB)

N70-11723# Army Foreign Science and Technology Center, Washington, D.C.
ANTENNAS FOR THE OPTICAL WAVE BAND
Yu. V. Tyzhnov et al 26 Aug. 1969 19 p refs Transl. into ENGLISH from the Russian
(AD-693230; FSTC-HT-23-309-69) Avail: CFSTI CSCL 17/2

This article describes antennas for optical band use with lasers for communication and location purposes. The use of very short waves makes it possible to employ extremely narrow bean antennas. Optical systems for use with transmitting and receiving antennas are described. Author (TAB)

N70-11738*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
A STUDY OF WEATHER-DEPENDENT DATA LINKS FOR DEEP SPACE APPLICATIONS
P. D. Potter, M. S. Shumate, C. T. Stelzried, and W. H. Wells 15 Oct. 1969 44 p refs
(Contract NAS7-100)
(NASA-CR-18957; JPL-TR-32-1392) Avail: CFSTI CSCL 17B

The information data rate of deep space communication links used for spacecraft-to-earth purposes is always severely limited by the size and power capacity of the spacecraft itself. Present deep space communication links, utilizing S band frequencies, have been improved to so high an efficiency that the information data rates obtainable cannot be increased significantly without attendant increases in spacecraft size. One solution to the problem of obtaining higher data rates is to operate the data link at frequencies higher than S-band. This report considers the operation of a reliable deep space communication link at such frequencies in the presence of weather disturbances, and presents a comparison of five potential systems: two microwave (X-band and mm-band) and three laser bands (10 micrometers, 4 micrometers and near visible). The advantages and disadvantages of each of these systems are discussed, and recommendations for future work in these areas are presented. Author

N70-11751*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
PROBLEMS OF WAVE DIFFRACTION AND PROPAGATION, NO. 7
E. M. Gyunninen, ed. Washington Washington Nov. 1969 241 p refs Transl. into ENGLISH of the publ. "Problemy Difraktsii i Rasprostraneniya Voln. VII" Leningrad, Leningrad State Univ. Press, p 1–208
(Contract NASw-1692)
(NASA-TT-F-591) Avail: CFSTI CSCL 20N

CONTENTS:

1. ASYMPTOTICS OF SOLUTIONS TO LINEAR SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS WITH A LARGE PARAMETER IN THE PRESENCE OF REVERSAL POINTS A. G. Alenitsyn p 1–20 refs (See N70-11752 02-07)

2. PROPAGATION OF ELECTROMAGNETIC WAVES IN PLANES AND SPHERICAL IMPEDANCE WAVEGUIDES. PART 1: CONSTRUCTION OF THE SOLUTION G. I. Makarov et al p 21–38 refs (See N70-11753 02-07)

3. PROPAGATION OF ELECTROMAGNETIC WAVES IN PLANE AND SPHERICAL IMPEDANCE WAVEGUIDES. PART 2: PROPAGATION OF ELECTROMAGNETIC WAVES IN A PLANE IMPEDANCE WAVEGUIDE G. I. Makarov et al p 39–74 (See N70-11754 02-07)

4. FINDING COMPLEX EIGENVALUES OF SOME BOUNDARY-VALUE PROBLEMS BY THE METHOD OF ANALYTICAL EXTENSION OF FUNCTIONS WITH A REAL AXIS ONTO THE COMPLEX RANGE OF THE ARGUMENT, APPLYING THE METHOD OF PROBLEMS OF SUPER-LONG WAVE PROPAGATION, WITH A CONSIDERATION OF THE EARTH'S MAGNETIC FIELD G. F. Remenets p 75–86 refs (See N70-11755 02-07)

5. A SOLUTION TO A WAVE EQUATION IN A SPHERICAL SYSTEM OF COORDINATES V. N. Krasilnikov p 87–100 refs (See N70-11756 02-07)

6. DIFFRACTION OF A PLANE ELECTROMAGNETIC WAVE ON AN IMPEDANCE SPHERE WITH RADIUS CHANGING IN TIME V. N. Krasilnikov p 101–117 refs (See N70-11757 02-07)

7. DIFFRACTION OF AN ELECTROMAGNETIC FIELD ON AN UNBOUNDED HOLLOW CYLINDER IN A CONDUCTING HALF-SPACE O. G. Kozina et al p 118–129 refs (See N70-11758 02-23)

8. DIFFRACTION OF AN ELECTROMAGNETIC WAVE ON A HOLLOW SPHERICAL DISCONTINUITY IN A CONDUCTING HALF-SPACE O. G. Kozina et al p 130–138 refs (See N70-11759 02-07)

9. SOME FORMULAS FOR SHORT WAVE ASYMPTOTICS IN THE THREE-DIMENSIONAL PROBLEM OF DIFFRACTION ON SMOOTH CONVEX BODIES D. Sh. Mogilevskiy p 139–150 refs (See N70-11760 02-23)

10. EFFECT OF A STEPLIKE DISCONTINUITY ON A FIELD

IN A PLANE WAVEGUIDE B. V. Nerinovskiy p 151–161 refs (See N70-11761 02-23)

11. THE PROPAGATION OF LONG RADIO WAVES AND THE NONHOMOGENEOUS IONOSPHERE E. M. Gyunninen et al p 162–172 refs (See N70-11762 02-07)

12. TAKING ACCOUNT OF THE NONUNIFORMITY OF THE IONOSPHERE IN THE PROBLEM OF SUPER-LONG WAVE PROPAGATION IN THE WAVEGUIDE CHANNEL EARTH-IONOSPHERE S. T. Rybachek p 173–185 refs (See N70-11763 02-07)

13. THE REFLECTION OF A "BELL" PULSE FROM A SYMMETRICAL EPSTEIN MEDIUM L. I. Bezruchenko p 186–194 refs (See N70-11764 02-07)

14. PERTURBATION OF ELECTROMAGNETIC FIELDS BY MOVING BODIES V. S. Gerasimov et al p 195–200 refs (See N70-11765 02-23)

15. ERRORS IN DETERMINING THE CHARACTERISTICS OF SUPERLONG-WAVE PROPAGATION BY THE METHOD OF HARMONIC ANALYSIS OF THE FORMS OF ATMOSPHERICS V. A. Krivoshein et al p 201–221 refs (See N70-11766 02-07)

16. EXPERIMENTAL STUDY OF THE DIPOLE AND CURRENT MOMENTS OF LIGHTENING DISCHARGES. PART 1: METHODS OF STUDYING A DIPOLE MODEL OF EMISSION SOURCES Yu. V. Shtennikov p 222–232 refs (See N70-11767 02-23)

N70-11752*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

ASYMPTOTICS OF SOLUTIONS TO LINEAR SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS WITH A LARGE PARAMETER IN THE PRESENCE OF REVERSAL POINTS

A. G. Alenitsyn *In its* Probl. of Wave Diffraction and Propagation, No. 7 Nov. 1969 p 1–20 refs (See N70-11751 02-07)

Avail: CFSTI CSCL 20N

A brief review is presented of the results known from literature which touch on the asymptotic behavior of the linear systems. The basic facts from the classical theory, which is applicable when there are no reversal points, are first given for comparison. Then the general method of approaching the problem of reversal points, the method of decomposition, is examined. The asymptotics is obtained with the aid of a standardization method over the real interval containing the simplest reversal points. Examples from acoustics and the theory of elasticity are given. Author

N70-11753*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

PROPAGATION OF ELECTROMAGNETIC WAVES IN PLANES AND SPHERICAL IMPEDANCE WAVEGUIDES. PART 1: CONSTRUCTION OF THE SOLUTION

G. I. Makarov et al *In its* Probl. of Wave Diffraction and Propagation, No. 7 Nov. 1969 p 21–38 refs (See N70-11751 02-07)

Avail: CFSTI CSCL 20N

The problems of the propagation of superlong radio waves in a surface waveguide channel formed by the surface of the earth and the ionosphere, by two parallel planes, or two concentric spheres are formulated. The general concepts on the methods of constructing the solutions are discussed, and a formal solution by the method of normal waves is presented for the case of plane and spherical waveguides. Author

N70-11754*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

PROPAGATION OF ELECTROMAGNETIC WAVES IN PLANE AND SPHERICAL IMPEDANCE WAVEGUIDES. PART 2: PROPAGATION OF ELECTROMAGNETIC WAVES IN A PLANE IMPEDANCE WAVEGUIDE

G. I. Makarov et al *In its* Probl. of Wave Diffraction and Propagation, No. 7 Nov. 1969 p 39–74 (See N70-11751 02-07)

Avail: CFSTI CSCL 20N

The problems of finding and investigating the behavior of the eigenvalues of a tranverse differential operator in the case of a plane waveguide are discussed in terms of the method of direct variations and the method of instances. The method of instances aids in obtaining rather simple analytical expressions for the eigenvalues of the transverse differential operator with relatively wide limits to applicability. These expressions can be used for a qualitative study of the principal rules for the structure of an electromagnetic field in plane impedance waveguides. Author

N70-11755*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

FINDING COMPLEX EIGENVALUES OF SOME BOUNDARY-VALUE PROBLEMS BY THE METHOD OF ANALYTICAL EXTENSION OF FUNCTIONS WITH A REAL AXIS ONTO THE COMPLEX RANGE OF THE ARGUMENT, APPLYING THE METHOD TO PROBLEMS OF SUPER-LONG WAVE PROPAGATION, WITH A CONSIDERATION OF THE EARTH'S MAGNETIC FIELD

G. F. Remenets *In its* Probl. of Wave Diffraction and Propagation, No. 7 Nov. 1969 p 75–86 refs (See N70-11751 02-07)

Avail: CFSTI CSCL 20N

A discussion is presented on how difficulties encountered in applying some results of the theory of superlong wave propagation based on the apparatus of boundary value problems are overcome with the aid of an approach based on an analytical continuation of the functions with a real axis of the argument into a complex range of regularity. Particular emphasis is given to the correctness of algorithms in the computational sense. Author

N70-11756*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

A SOLUTION TO A WAVE EQUATION IN A SPHERICAL SYSTEM OF COORDINATES

V. N. Krasilnikov *In its* Probl. of Wave Diffraction and Propagation, No. 7 Nov. 1969 p 87–100 refs (See N70-11751 02-07)

Avail: CFSTI CSCL 20N

The method of separation of variables which is often used in solving diffraction problems in a spherical system of coordinates needs modifications in certain particular cases. The requisite modifications are presented, and examples are cited. Author

N70-11757*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

DIFFRACTION OF A PLANE ELECTROMAGNETIC WAVE ON AN IMPEDANCE SPHERE WITH RADIUS CHANGING IN TIME

V. N. Krasilnikov *In its* Probl. of Wave Diffraction and Propagation, No. 7 Nov. 1969 p 101–117 refs (See N70-11751 02-07)

Avail: CFSTI CSCL 20N

The diffraction of a plane electromagnetic wave is analyzed mathematically. Even the simplest examples presented clearly show the uniqueness of the process of wave diffraction on bodies of variable size. The Debye potentials corresponding to an incident linearly-polarized plane electromagnetic wave are defined. Author

N70-11759*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

DIFFRACTION OF AN ELECTROMAGNETIC WAVE ON A HOLLOW SPHERICAL DISCONTINUITY IN A CONDUCTING HALF-SPACE

O. G. Kozina et al *In its* Probl. of Wave Diffraction and Propagation, No. 7 Nov. 1969 p 130–138 refs (See N70-11751 02-07)

Avail: CFSTI CSCL 20N

The problem of the case when there is a discontinuity in the form of a spherical shell located in the vicinity of the boundary surface in the conducting half space of a two-layered medium is treated. It is shown that the field of a vertical dipole is more sensitive to discontinuities than that of a horizontal one. It is also shown that, under certain conditions, the ratio between the

field diffracted on a cylinder and the direct one is always greater than in the case of a sphere, and that this result can be anticipated by considering the geometry of the problem. Author

N70-11762*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE PROPAGATION OF LONG RADIO WAVES AND THE NONHOMOGENEOUS IONOSPHERE
E. M. Gyuninen et al *In its* Probl. of Wave Diffraction and Propagation, No. 7 Nov. 1969 p 162–172 refs (See N70-11751 02-07)
Avail: CFSTI CSCL 20N

It is shown that the method of constructing the solution to the problem of wave propagation with the aid of rays for the earth–ionosphere waveguide channel with subsequent approximation is valid when the dependance of the waveguide height on the distance along the earth's surface is considered. Author

N70-11763*# Aztec School of Language, Inc., Maynard, Mass. Research Translation Div.
TAKING ACCOUNT OF THE NONUNIFORMITY OF THE IONOSPHERE IN THE PROBLEM OF SUPER-LONG WAVE PROPAGATION IN THE WAVEGUIDE CHANNEL EARTH-IONOSPHERE
S. T. Rybachek *In its* Probl. of Wave Diffraction and Propagation, No. 7 Nov. 1969 p 173–185 refs (See N70-11751 02-07)
Avail: CFSTI CSCL 20N

A study is continued on the problem of the field of a vertical electric dipole in a waveguide whose walls are formed by the earth, characterized by finite conductivity, and a uniform isotropic ionosphere, expanded for the cases of an ionosphere which is nonuniform in terms of the radial coordinates. The difficulties encountered with this problem are cited, and methods of overcoming them are suggested. Author

N70-11764*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE REFLECTION OF A "BELL" PULSE FROM A SYMMETRICAL EPSTEIN MEDIUM
L. I. Berruchenko *In its* Probl. of Wave Diffraction and Propagation, No. 7 Nov. 1969 p 186–194 refs (See N70-11751 02-07)
Avail: CFSTI CSCL 20N

The problem of the reflection of a bell pulse is discussed in relation to the use of ground-based radiophysical methods of obtaining real profiles for the electron concentration in the ionosphere. The criteria for formulation of the problem are cited, and the spreading of a reflected pulse, the displacement of the maximum of the reflected signal and the frequency modulation of this signal are examined. Author

N70-11768*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
ERRORS IN DETERMINING THE CHARACTERISTICS OF SUPERLONG-WAVE PROPAGATION BY THE METHOD OF HARMONIC ANALYSIS OF THE FORMS OF ATMOSPHERICS
V. A. Krivoshein et al *In its* Probl. of Wave Diffraction and Propagation, No. 7 Nov. 1969 p 201–221 refs (See N70-11751 02-07)
Avail: CFSTI CSCL 20N

The errors involved are discussed, and methods of eliminating them are investigated. A detailed analysis of the algorithms for determining the attenuations and phase velocities with the purpose of finding the sources of possible errors, the specific characteristics of these errors, and estimates of their magnitude is presented. Author

N70-11779*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IONOSPHERIC PERTURBATIONS ON STADAN VHF TRACKING ACCURACY
B. Rosenbaum Sep. 1969 80 p refs
(NASA-TM-X-63738; X-551-69-403) Avail: CFSTI CSCL 17I

Ionospheric propagation effects are a major factor limiting tracking accuracy of the VHF systems of STADAN. Parametric analysis of the ionospheric perturbations were undertaken. The establishment of the significance of the horizontal gradients within the ionospheric medium were specifically studied. Journal publications are surveyed for the observational data pertaining to the level of horizontal gradients of N sub t maximum total integrated electron content. The interest of Minitrack, an interferometer scheme for precision measurement of direction cosines, is that a finite refraction prevails at the zenith which, at times, can exceed instrumental errors. A general result emerging from the analysis of ionospheric perturbations is the central role of N sub t and its horizontal gradients. The limitation to correction of ionospheric effects on tracking data stems from the wide variability and irregular temporal behavior of N sub t as well as its geographical dependance. An observational scheme is sketched for the monitoring of N sub t at STADAN sites which could materially relieve the limitation. Author

N70-11911*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
AMPLITUDE AND PHASE SCINTILLATION OF HIGH FREQUENCY SATELLITE SIGNALS DUE TO IONOSPHERIC INHOMOGENEITIES
M. L. Rafael 1 Nov. 1969 186 p refs
(Grant NGR-39-009-002)
(NASA-CR-106913; SR-342) Avail: CFSTI CSCL 17B

This investigation is of the diffraction of high frequency radio waves by inhomogeneities of ionospheric electron density with emphasis on the effects of the inhomogeneities on the phase of the received signals. Experimental results show that the irregularities responsible for the scintillation of satellite signals observed during the hours of darkness are located at heights of 400 to 700 km above the earth's surface. The height structure is very complex. The amplitude and phase patterns on the ground are both elongated in the direction which would be expected if the irregularities which are responsible are greatly elongated along the earth's magnetic field. The irregularities have scale sizes in the direction transverse to the magnetic field of approximately 2 to 3 km as obtained from phase measurements. The transverse scale sizes as deduced from amplitude measurement are typically a factor of 4 to 7 times smaller than the sizes obtained from the phase measurements. This condition would be expected in view of the high phase deviations observed, and the fact that the amplitude pattern is largely caused by smaller size components of the spectrum of inhomogeneities. Author

N70-12056# Syracuse Univ., N.Y. School of Library Science.
FOUR NEW SCIENCES: AN APPROACH TO COMPLEXITY
E. B. Montgomery *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 p 41–48 (See N70-12051 02-08)
Avail: CFSTI

Present-day discoveries are causing an exponential growth in information because a discovery in one field may very well lead to new discoveries and the generation of new information in other, related fields and even in other disciplines. The problem is one of coping with complexity. Four new sciences, not new in themselves, but looked at from new points of view are suggested as solutions, namely information science, communication science, system science and application science. Finally, it is suggested that the science of science itself may provide answers to some of the problems. Author

N70-12132# Joint Publications Research Service, Washington, D.C.
OTHER RESEARCH

In its Upper Atmosphere and Space Res. in the USSR in 1968 1 Aug. 1969 p 53–58 (See N69-12126 02-30)
Avail: CFSTI

Cosmos satellite measurements are evaluated and compared with theoretical computations and laboratory experiments. Results establish the following findings: (1) the coefficient of transmission of superlong radio waves at nighttime is 50–70 percent; (2) the regions of X-ray flares on the sun have a fibrous structure and exhibit rapid spatial changes; (3) the modeling of the inter-action between solar wind and the earth's magnetic field produced phenomena of the interplanetary plasma; (4) the effects of space flight on biological specimens; and (5) the solutions to fundamental scientific and technical problems encountered in the successful return to earth of space ships. G.G.

N70-12222*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-58, VOLUME 2: FOR THE PERIOD 1 MAY TO 30 JUNE 1969. Deep Space Network
31 Jul. 1969 170 p refs
(Contract NAS7-100)
(NASA-CR-106972; JPL-SPS-37-58-Vol-2) Copyright. Avail: CFSTI CSCL 17B

The Deep Space Network (DSN) is designed for two-way communications with unmanned spacecraft traveling approximately 10,000 mi from earth to planetary distances. To support flight projects, the DSN simultaneously performs advanced engineering on components and systems, integrates proven equipment and methods into the network, and provides direct support of each project through that project's Tracking and Data System. The DSN operation is characterized by six systems (tracking, telemetry, command, monitoring, simulation, and operations control) and is comprised of three facilities (the Deep Space Instrumentation Facility, the Ground Communications Facility, and the Space Flight Operations Facility). Author

N70-12238# RAND Corp., Santa Monica, Calif.
A NEW METHOD FOR FINDING OPTIMAL SIGNAL DETECTORS AND ESTIMATORS IN THE PRESENCE OF NOISE
Percy A. Pierre and William L. Root Aug. 1969 31 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-692701; RM-6089-PR) Avail: CFSTI CSCL 9/4

A new method for finding solutions to the problems of 1) detecting a known signal in Gaussian noise, 2) detecting a Guassian signal in Gussian noise, and 3) the problem of finding the best linear estimate of signals in noise. It is shown that all three problems can be reduced to the problem of solving a generalized integral equation. The main result is a new method for solving such equations. The method is general in that it is applicable to any ordinary integral equation with a positive definite kernel. Author (TAB)

N70-12316# Lockheed Missiles and Space Co., Palo Alto, Calif.
ELASTIC WAVE PROPAGATION ON A HALF-PLANE WITH HOLES
N. A. Shulga 6 Jun. 1968 4 p refs Transl. into ENGLISH from Dopo. Akad. Nauk Ukr. RSR, Ser. A, no. 9, 1969 p 839–842
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

An infinite system of algebraic equations is developed for the reduction of the boundary value problem for stationary plane elastic wave propagation in a half-plane with a finite number of circular holes. The half-plane is analysed as a coordinate system with each of the contours in a local coordinate system. Polar coordinates are transformed to rectangular coordinates. The construction of the formal solution to the boundary value problem is demonstrated. M.H.E.

N70-12342# California Inst. of Tech., Pasadena. Antenna Lab.
RADIATION FROM AN ANTENNA ENTERING THE MARTIAN ATMOSPHERE
John D. Norgard Jun. 1969 167 p refs
(Grant AF-AFOSR-1400-68)
(AD-693220; TR-49; AFOSR-69-1331-TR) Avail: CFSTI CSCL 9/6

The interaction between the ionized wake of a capsule entering the Martian atmosphere and the circularly polarized radiation emitted by an antenna located on the aft part of the capsule is theoretically investigated. A simplified mathematical model of the atmosphere of Mars, the entry-trajectory of the capsule, and the flow field surrounding the capsule are used in the analysis. The near wake of the capsule is approximated by a cylindrically stratified plasma shell consisting of n plasma regions. The plasma in each region is assumed to be homogeneous, anisotropic, and conducting, and moving at a uniform velocity relative to the antenna. The antenna is represented by a turnstile antenna located off-axis above an infinite ground plane and operates at the signal frequencies of 400 MHz and 2.295 GHz. The analysis shows that blackout occurs during entry. Before and after blackout the radiation exhibits an on-axis null region whose angular extent is proportional to the electron concentration of the plasma. Author (TAB)

N70-12419# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE OPTIMUM RESOLUTION OF RADAR OBJECTS
V. M. Gerasimov 5 May 1968 12 p refs Transl. into ENGLISH from Radiotekhn. i Elektron., v. 14, no. 9, 1969 p 1572–1583
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Problems of optimum resolution of radar objects in the detection and measurement stages are examined from the aspect of a general functional approach. Block diagrams of optimal systems are presented, their characteristics are found, and some peculiarities of their technical realization are discussed. Author

N70-12438# General Electric Co., Schenectady, N.Y. Research and Development Center.
NANOSECOND RADAR-OVERSIZE WAVEGUIDE SYSTEM (NAROWS) Final Technical Report, 15 Oct. 1968–15 May 1969
Cousby Younger, John P. Quine, A. E. Blume, and John W. Maurer Sep. 1969 66 p refs
(Contract F30602-69-C-0066)
(AD-693219; RADC-TR-69-253) Avail: CFSTI CSCL 17/9

The report summarizes the results of a study to determine the optimum configurations for the components of a feed system for a high-power nanosecond-pulse high-resolution S-Band radar system. The system employs 8.00 X 5.36 inch oversize rectangular waveguide. Developmental model system components including power combiners, load switches, straight waveguides, H-plane, bends, horn radiators, and horn radomes are described. The breadboard model system consisting of duplexers rotory joints and sampling couplers is also described. Author (TAB)

N70-12437*# Checchi and Co., Washington, D.C.
SATELLITE AND TERRESTRIAL TELECOMMUNICATIONS DEVELOPMENT
1969 239 p refs Prepared with Philco-Ford, Philadelphia
(Contract NASw-1357)
(NASA-CR-107151) Avail: CFSTI CSCL 17B

Part One of this report first examines the impact of Global Comsat on the developing nations. It then summarizes the findings, study methods, and principal lessons learned in studies dealing with telecommunications in Africa. Substantive problems requiring further study are identified, and principal policy issues involved in improving telecommunications in developing countries are discussed. Part Two is directed toward government officials concerned with the design of telecommunications studies for developing nations. Author

N70-12475*# Alabama Univ., University. Communication Systems Group.

A DIGITAL TECHNIQUE TO COMPENSATE FOR TIME-BASE ERROR IN MAGNETIC TAPE RECORDING
Richard S. Simpson, Ronald C. Houts, and Donald W. Burlage Oct. 1968 97 p refs
(Contract NAS8-20172)
(NASA-CR-102360; TR-15) Avail: CFSTI CSCL 07B

A digital technique is presented for compensation of time base error in magnetic tape recorder data. A buffer shift register with feed-back control is used to obtain a variable delay of the recorded signal during playback. A breadboard version is described and typical experimental results are provided to demonstrate the performance of the system. A mathematical model of the system is developed and justified by comparing analytical results with data from the breadboard model. The feasibility of the technique for airborne tape recorders is predicted based upon an estimate of system weight, size, and cost. Author

N70-12482# RAND Corp., Santa Monica, Calif.
THE EFFECTS OF IONS ON VLF PROPAGATION DURING POLAR CAP ABSORPTION EVENTS
E. C. Field Aug. 1969 34 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-692700; RM-6058-PR) Avail: CFSTI CSCL 17/2.1

Theoretical analysis of the propagation of electromagnetic waves in the very-low-frequency range (8 – 30 K Hz) in the earth-ionosphere waveguide. Full wave methods incorporating the vertical inhomogeneity of the ionosphere are used. The model ionospheres, which correspond to both normal and disturbed PCA conditions, are chosen to illustrate the sensitivity of the propagation to various ionospheric properties. Spherical geometry is used for computing attenuation rates, phase velocities, and height dependences of the electromagnetic fields and of Joule heating. A major but justifiable simplification in the study is the omission of the geomagnetic field. Results of the calculations indicate that transpolar VLF waves suffer a great deal more attenuation during moderate PCA events than during the undisturbed daytime. Author (TAB)

N70-12483# Syracuse Univ. Research Corp., N.Y.
ANALYSIS OF REAL-TIME REFRACTION CORRECTION METHODS FOR THREE MISSILE FLIGHTS FROM THE AIR FORCE WESTERN TEST RANGE
Lyall G. Rowlandson and John R. Herlihy Bedford, Mass. ESD Jul. 1969 71 p refs
(Contract F19628-68-C-0209)
(AD-692785; ESD-TR-69-280) Avail: CFSTI CSCL 17/9

An emphasis is placed on the real-time correction of refraction-induced tracking errors. With radar data from three missile trajectories the corrected range and angle data, using real-time equations, is compared with ray-traced data. It is shown that these equations can be effectively used to reduce the range and angle errors to about the resolution of the tracking radars that is, approximately two feet in range and five thousands of a degree in angle. It is also shown that the effect of an elevated layer on tracking angle errors can be compensated using these equations. Author (TAB)

N70-12494# Air Force Cambridge Research Labs., Bedford, Mass. Ionospheric Physics Lab.
USING THE RINGING IRREGULARITY AS AN ANALYTICAL TOOL
Frederick F. Slack Jul. 1969 27 p refs *Its* Phys. Sci. Res. Paper 387
(AD-693586; AFCRL-69-0297) Avail: CFSTI CSCL 17/2.1

The hypothesis is advanced that a high percentage of ionospheric scintillation is a distortion of a regular cyclic type of fading seen occasionally on chart recordings of HF and VHF radio frequency signals that have penetrated the ionosphere. Analysis of satellite signals containing this special type of anomaly leads to a better understanding of ionospheric scintillation in general. The paper shows how many properties of normal scintillation are consistent with the two ray interference formula derived for the more orderly pattern. As an illustration we have included the analysis of an ionospheric irregularity appearing over Thule that provides height and electron density measurements. Author (TAB)

N70-12647# Wilcox Electric Co., Inc., Kansas City, Mo.
INVESTIGATION AND DEVELOPMENT OF MODIFICATIONS TO RESOLVE AIRBORNE/GROUND GLIDEPATH TRACKING PROBLEMS Final Report
David M. Staehling Jun. 1969 162 p
(Contract FA-67-WA-1636)
(SRDS-RD-69-36) Avail: Issuing Activity

Investigations were made to ascertain the cause or causes of tracking errors (discrepancies in course information derived from two separate glide path antennas) observed by FAA flight-check aircraft. A null reference/capture effect facility was installed and numerous tests were made. Most tests were made with a portable crankup tower to probe the path but flight checks were made also. It was concluded that tracking errors are observed because: (1) There are vertically polarized components of signals in space that contain false course information. (2) The two aircraft receiving antennas do not reject these vertical signals sufficiently and differ in their degree of rejection of these vertical signals. Polarization tests were made on various glide path antenna installations. Two of the best antennas were then used for flight checking, and were found to track much better than two 37P4 antennas installed in the radome. A glide path polariscope was assembled and used to flight check several facilities. The results indicated that the polariscope is a good way to measure vertical polarization error. Author

N70-12583# Akademiya Nauk URSR, Kiev.
OPTIMUM ALGORITHMS FOR ADJUSTING HARMONIC CORRECTOR FOR MINIMUM ROOT MEAN SQUARE ERROR
V. A. Kisel *In its* Methods for Collecting and Process. Inform. 1967 p 71 – 86 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

Two algorithms are presented which characterize the tuning of communication channel harmonic correctors in such a way that the total root-mean-square error of output signal deviation is minimized. The first algorithm is based on the sequential optimization method; the second is based on the 'rapid output' method. The algorithms are constructed using z-transformations to transform random signals into prescribed signals. Although the rapid output method ensures optimum high speed tuning of the corrector, its implementation is more complicated than the sequential optimization method. Transl. by E.C.

N70-12585# Akademiya Nauk URSR, Kiev.
STABILIZATION OF TRANSMITTER CHARACTERISTICS IN THERMALLY STABILE TELEMETRY SYSTEM
V. P. Bodunov and A. N. Svenson *In its* Methods for Collecting and Process. Inform. 1967 p 98 – 108 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

Two methods are compared for stabilizing telemetry transmission characteristics within individual modules. The first method is based on negative or compensating feedback; the second on automatic correction of the zero level and transmission coefficients. Recommendations are given for applying these methods to thermally stabile telemetry systems. Transl. by E.C.

N70-12588# Akademiya Nauk URSR, Kiev.
REPRESENTATION FOR CYLINDRICAL HANKEL FUNCTIONS AT SUFFICIENTLY LARGE VALUES FOR ARGUMENT
V. F. Kulko *In its* Methods for Collecting and Process. Inform. 1967 p 109 – 112 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

Formulas for Hankel functions of the first and second order are described. The formulas are valid for index values less than or equal to absolute values of an argument. They are also convenient for calculations relating to electromagnetic channels for data transmission. Transl. by E.C.

N70-12587# Akademiya Nauk URSR, Kiev.
A VARIABLE-CYCLE MULTICHANNEL SYSTEM FOR TELEMETRY OF THE INTENSITY OF STATIONARY POISSON PROCESSES
R. F. Fedoriv *In its* Methods for Collecting and Process. Inform. 1967 p 113–119 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

By averaging anticipation time, the intensity of a random process with Poisson distribution can be measured with a given statistical accuracy. Since average anticipation time is inversely proportional to intensity, a special integrator circuit is used to obtain a linear scale. In telemetry of nuclear radiation intensity, the events of nuclear decay much longer than measurement time may be considered as a stationary Poisson process without aftereffects. For this process the event of nuclear decay is not dependent on the preceding state, i.e. appearance of the signal is not dependent on the preceding state of the system or on the time of switching it on. Assuming that the system described is connected at an arbitrary moment in time to a certain signal source and is switched off by short impulses of this source (the radiation detector), signal anticipation time can be determined from the Poisson distribution between events. Transl. by R.B.

N70-12588# Akademiya Nauk URSR, Kiev.
A UNIVERSAL CIRCUIT FOR A MULTICHANNEL COMMUTATOR
Ya. Ye. Belenkiy *In its* Methods for Collecting and Process. Inform. 1967 p 120–125 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

Under emergency conditions a commutator must be able to reverse itself and to operate in a step, cyclic, or start-stop mode in both forward and reverse directions. A commutator with cyclic interrogation can be constructed by using a self-exciting, multiphase flip-flop generator, and one with step interrogation by using one of several multiphase binary flip-flops. Known keyed matrix circuits are used to generate the control signals of appropriate sign to the control triodes. The start-stop mode of the commutator described is achieved in a manner similar to that of a multiphase flip-flop generator. The commutator circuit is switched to self-oscillating mode and the triggering voltage is fed to the base of one of the main series of triodes. The triode selected is the first. The bias at the common emitter resistor cuts off all remaining triodes of the main and secondary series. After the triggering cut-off pulse has been transmitted to the input stage of the first triode, the circuit generates a sequence of command pulses by all stages, until the first triode is triggered, after which it again switches itself off until the next triggering pulse arrives. Transl. by R.B.

N70-12589# Akademiya Nauk URSR, Kiev.
A METER FOR MEASURING THE AVERAGE INTERVAL BETWEEN PULSES
A. A. Bragin and R. F. Fedoriv *In its* Methods for Collecting and Process. Inform. 1967 p 126–130 ref In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

Assuming that the duration of pulses and pauses in a system is distributed according to a certain probability law, the values of the pulses and pauses can be calculated by using a comparatively simple circuit with a charging capacitor on the single condition that pulse duration is not less than a certain finite amplitude. On the basis of equations derived, the meter scale is linear and the statistical error of measurement is not dependent on the value of the measured interval; it remains constant over the entire range of measurement. The operational quality of the circuit is illustrated graphically as the dependence of output voltage on the value of the average interval. Transl. by R.B.

N70-12592# Akademiya Nauk URSR, Kiev.
OPTIMUM RECEPTION OF PULSE SIGNALS IN PHOTOSTORAGE
V. N. Pervushin and V. V. Tretyakov *In its* Methods for Collecting and Process. Inform. 1967 p 151–155 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

The limitation in decreasing the signal-to-noise ratio, and also in appreciably increasing storage time, is the contrast between the densities of dark spots on the photographic film, occupied by interference, and the signal and noise mixture. The properties of the photographic film are determined by a sensitogram – the dependence of dark-spot density on exposure value. Experiments show that the best results in signal-to-noise ratio can be obtained if the maximum value of dark-spot density on the section of film occupied by noise is selected in the upper part of the proportional transmission zone. The entire dynamic range of the film is used for this process. Transl. by R.B.

N70-12605*# Alabama Univ., University. Bureau of Engineering Research.
ANALYSIS OF ATMOSPHERICALLY INDUCED ERRORS IN AN OPTICAL TRACKING SYSTEM Quarterly Report, 14 Oct. 1968 – 14 Jan. 1969
William E. Webb Jan. 1969 27 p refs
(Contract NAS8-30507)
(NASA-CR-102351; QR-1) Avail: CFSTI CSCL 17B

Expressions are presented for the magnitude of root mean square tracking errors as a function of the aperture of the receiving optics. The analysis is limited to angle of arrival fluctuations in atmospheric turbulence. Two assumptions are made in the derivation: (1) the tracking system effectively measures the centroid of illuminance in the focal plane of a well corrected lens, and (2) the fluctuations in the amplitude of the incoming wave may be neglected compared to fluctuations in its phase. Expressions are also derived for the root mean square deviation of the apparent angle of arrival of an optical tracking system laser beam in terms of azimuth and elevation angles. A definition of the angle of arrival of distorted electromagnetic waves is made by analysis of the physical operation of the tracking system and by the assumption that the tracker measures the instantaneous position of the centroid of illuminance in the plane of the detector. The available data does fit a D to the minus one-sixth power law to within the experimental error. M.H.E.

N70-12614*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
SERVO SYSTEM Patent Application
Edmund J. Bahm, inventor (to NASA) Filed 9 Jul. 1969 20 p
(Contract NAS7-100)
(NASA-Case-NPO-10700; US-Patent-Appl-SN-840308) Avail: CFSTI CSCL 09A

Described is a simplified servo system particularly adapted for use in driving variable speed tape recorders aboard space craft. The present invention takes advantage of existing DC motor servo systems by using a DC to AC inverter to drive an AC motor at slow speeds. The instantaneous rate of the motor is detected by a tachometer and converted to an electrical sinusodial signal which is then delivered through a circuit and a low pass filter to provide a constant level rate signal having an amplitude proportional to the speed of the motor. By employing a current regulator for controlling the amperage through the coils, the flux density of the rotating magnetic field may be varied for controlling the speed of the motor independently of the position of the rotor, for thereby achieving and maintaining smooth torque outputs at low speeds and thus eliminating a need for reduction gear trains and the like. NASA

N70-12616*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SYSTEM FOR IMPROVING SIGNAL-TO-NOISE RATIO OF A COMMUNICATION SIGNAL Patent Application
George D. Arndt, inventor (to NASA) Filed 28 Aug. 1969 14 p
(NASA-Case-MSC-12259-1; US-Patent-Appl-SN-853763) Avail: CFSTI CSCL 09F

A superconductive resonant cavity is energized with radio-frequency energy. The cavity includes a tuning stub having a piece of semiconductor material mounted on the end thereof. An incoming communication signal modulates a light source which is optically coupled to the semiconductor material by a fiber optic bundle. This varies the dielectric constant of the semiconductor material which, in turn, varies the resonant frequency of the cavity. An angle modulation demodulator senses the frequency of the radio-frequency oscillations in the cavity and produces a replica of the communication signal having an improved signal-to-noise ratio. NASA

N70-12617*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
METHOD AND APPARATUS FOR MAPPING PLANETS Patent Application
Richard L. Horttor and Richard M. Goldstein, inventors (to NASA) Filed 9 Sep. 1969 26 p
(Contract NAS7-100)
(NASA-Case-NPO-11001; US-Patent-Appl-SN-856279) Avail: CFSTI CSCL 17I

Radar techniques described use of a moving transmitter and an earthbound receiver to map planetary surfaces. This requires proper tracking of the round trip delay between three variable communication links. The solution to the tracking problem involves the use of a transmitted PN code and auto-correlation with a locally generated PN code. NASA

N70-12621*# Hughes Aircraft Co., Los Angeles, Calif.
VIRTUAL-WALL SLOT CIRCULARLY POLARIZED PLANAR ARRAY ANTENNA Patent Application
Arthur F. Seaton, inventor (to NASA) Filed 11 Aug. 1969 31 p
Prepared in cooperation with JPL
(Contracts NAS7-100; JPL-950056)
(NASA-Case-NPO-10301; US-Patent-Appl-SN-848810) Avail: CFSTI CSCL 09F

A circularly polarized planar array antenna is provided by a multimode waveguide with alternately displaced transverse slots over virtual walls for one component, and conventional series or shunt slots between virtual walls for the other component of a circularly polarized beam. Actual walls may be inserted in the place of the virtual walls for unbalanced excitation of the array with a quarter-guide wavelength choke under each wall slot. NASA

N70-12690# Joint Publications Research Service, Washington, D.C.
RADIO POLARIMETRY AT SEA
D. B. Kanareykin et al 24 Nov. 1969 30 p Transl. into English from the book 'Morskaya Polyarimetriya' Leningrad, Sudostroyeniya, 1968 p 294–320
(JPRS-49302) Avail: CFSTI

The polarization characteristics and effects of sea surface are discussed with respect to marine radar navigation. The superposition of two statistically rough surfaces is considered to be the best model. One of the surfaces is large-scale and smooth and is selected according to large sea waves. The parameters of the second surface are chosen with regard to small deviations from the mean values corresponding to the first surface. Details are given on the development of the model and on the comparison with experimental data. The polarimetry of waves scattered in the direction of a mirror beam is determined. The effect of the sea surface is considered with matrices describing transformations of wave polarization during formation of the field irradiating the target, during scattering of the wave on the target, and during backward propagation of signals from the target to the radar set antenna. It is pointed out that it is more difficult to account for the influence of the sea surface in the presence of waves. Polarimeter antenna configurations are discussed for marine navigation. N.E.N.

N70-12701# Signals Research and Development Establishment, Christchurch (England).
A CONCLUDING NOTE ON THE SAGEM TYPE SPE SERIES 5 SEMI-ELECTRONIC TELEPRINTER
H. Gates, D. Thomas, and R. A. Wood Apr. 1969 23 p
(SRDE-69016) Avail: CFSTI

This report, which incorporates and earlier SRDE memorandum (No. T3/68), briefly describes the SAGEM semi-electronic teleprinter. It also discusses the performance and fault record of a sample machine operating over a period of 3000 hours, and comments on its construction. Author (ESRO)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N70-11432# Washington State Univ., Pullman.
A PROGRAMMABLE DATA CONCENTRATOR FOR A LARGE COMPUTING SYSTEM
H. Blair Burner, Richard P. Million, Otis W. Rechard, and John S. Sobolewski 1 May 1969 39 p refs
(Contract N00014-68-A-0410-0001)
(AD-693546; WSU-1969-1) Avail: CFSTI CSCL 9/2

Most large time sharing computers require some sort of a data concentrator or multiplexer to accept inputs from a large number of low speed remote terminals. Two major disadvantages of most of these concentrators are that they are non-programmable and relatively expensive. This paper describes the use of a small micro-programmed computer with a special instruction wired into the Read Only memory to perform the multiplexing action. This approach has resulted in a programmable terminal controller which will handle up to 32 remotes and provides enough processing capability to do code conversion and editing. This not only relieves the main computer of these routine tasks, but also reduces the amount and complexity of system modification within the main computer. A dual processor system with a common memory is also proposed. This system will handle sixty-four low speed lines and four 2400 baud lines yet will have 15 times the processing power of the previous system. This will allow more sophisticated pre-processing, such as syntax checking in addition to the code conversion and editing. The cost of this system is less than that of some currently available non-programming terminal controllers that will handle a similar number of lines. Author (TAB)

N70-11435# Stanford Research Inst., Menlo Park, Calif.
PROMENADE AN IMPROVED INTERACTIVE GRAPHICS MAN/MACHINE SYSTEM FOR PATTERN RECOGNITION Final Technical Report 27 Jun. 1967–30 Sep. 1968
David J. Hall, Geoffrey H. Ball, Daniel E. Wolf, and James W. Eusebio Griffiss AFB, N.Y. Rade Jun. 1969 179 p refs
(Contract-F30602-67-C-0351)
(AD-692752; RADC-TR-572) Avail: CFSTI CSCL 9/2

The report describes the concluding year of a two-year research effort on man/computer interaction using, as principal interface, a high-performance CRT screen for computer output and a typewriter-like keyboard for input to the medium-size CDC 3100 computer. A computer system (PROMENADE) for multivariate data analysis and pattern recognition, is described. The PROMENADE system is used to explore data using a number of manipulative, graphic and numeric programming subsystems that are linked together under a single executive program. Interactive interface between subsystems is as important as interactive interface

between computer and user. Principal features of the system are convenience, flexibility, and on-line interaction. Facilities are available for keeping a record of the analysis, using the line printer, still and movie cameras, and the off-line plotting table. Author (TAB)

N70-11456# Illinois Univ., Urbana. Biological Computer Lab.
ON THE REALIZATION OF LINEAR AUTOMATA
Thomas J. Wey Jun. 1969 121 p refs
(Grant AF-AFOSR-7-67)
(AD-693553; AFOSR-69-2332TR; TR-14) Avail: CFSTI CSCL 9/2

The study deals with the synthesis of linear discrete systems, and it considers the cases in which the information of their internal structure is defined or remains unspecified. A linear system is one whose output is a linear function of either the input and the state or a finite number of past inputs and past outputs. Necessary and sufficient conditions for linearity of the flow table of a system are derived. The set of conditions for linearity leads to a method for coding the set of output vectors of the system. Many special properties of the flow table of a linear system are found. Based on these properties, a synthesis procedure is established: it begins with the testing for linearity of the flow table of a system and ends with the construction of the behavior functions of the system. Both the Mealy and the Moore models are discussed in detail. The synthesis procedure is straight forward and in addition to being free of trial and error, it is also applicable to incompletely specified automata and singular systems. The optimization of the realization of linear automata is also discussed. Author (TAB)

N70-11477# Probe Consultants, Inc., Phoenix, Ariz.
MICRO-FORM FORMATS AND INTERPRETERS IN THE PILER SYSTEM Annual Progress Report, 1 May 1968 - 1 May 1969
Penny Barbe 1 May 1969 22 p
(Contract N00014-67-C-0472)
(AD-693296; PLR-003) Avail: CFSTI CSCL 9/2

The PILER System is an automatic computer program translator which translates a source machine language program to a target machine language program. It performs this function by de-compiling a source machine-language program and re-compiling the subject program on the target computer. The three phases of the de-compiling process (PILER) are (I) Interpretation of the subject program commands; (II) Analysis of subject program for function and purpose and data analysis; and (III) Expression of subject program in a compiler language. Each phase of the PILER is discrete and self-contained. Thus, any number of Phase I interpreters can be produced which will allow any computer to be considered the source computer. Any number of Phase III translators can be produced which will allow any computer to be considered the target computer, through any compiler medium. The report describes the Phase I interpreters and defines the Microform format the interpreters use to communicate with the Analyzer. Author (TAB)

N70-11516# Army Foreign Science and Technology Center, Washington, D.C.
ADAPTIVE SYSTEM FOR COLLECTING AND PROCESSING INFORMATION
Ye. I. Gubenko 25 Aug. 1969 9 p Transl. into ENGLISH from Prib. Sist. Actomatiki (Kharkov), no. 2, 1966 p 140-143
(AD-693242; FSTC-HT-23-1119-68) Avail: CFSTI CSCL 9/2

In information processing systems, the time spent in interrogation delays the time for error correction by the system of automatic regulation. An improvement is offered by a system using an adaptive alternating cycle of operation and a parameter selection for error correction. The system consists of determining the standard deviation of the corresponding parameter and working out a correction for the parameter which has evolved from the operation. Data units may be grouped together and only those parameters which show deviation are dealt with in the course of information processing. A functional diagram of this system of information processing is included. TAB

N70-11563# Radio Corp. of America, Princeton, N.J.
CDL1, A COMPUTER DESCRIPTION LANGUAGE. PART 1: THE NATURE OF THE DESCRIPTION LANGUAGE AND ORGANIZATION OF DESCRIPTIONS. PART 2: KINDS OF DESCRIPTIONS OF A COMPUTING SYSTEM
Chitoor V. Srinivasan Jul. 1969 35 p refs
(Contract F19628-68-C-0070)
(AD-693555; AFCRL-69-0322; SR-3) Avail: CFSTI CSCL 9/2

Part I of this report introduces some of the basic principles that guided us in the development of the Computer Description Language, CDL1. The language is addressed totally to the creation of a descriptive data base of a computing system, which could be used for a variety of design aid applications. The nature of CDL1 and the organization of descriptions based on an object classification scheme are discussed. It is shown that the classification of an object name is relevant to the way the name would be defined, and the way the definition would be filed. Part II discusses the levels of abstraction at which a system could be described, and the significance of such descriptions in a design environment. Our interest here is to investigate how, for a system with a given abstract architecture, its detailed specification evolves during design. We wish to identify the significant stages of design, consider modes of descriptions appropriate for each design stage, and relate the descriptions to the design problems faced by the designers at each stage. At the end of design we wish to obtain an analytic description of the system. The concepts are discussed with a running example. Author (TAB)

N70-11586# System Development Corp., Santa Monica Calif.
IMAGES OF AFL UNDER CERTAIN FAMILIES OF HOMOMORPHISMS
Seymour Ginsburg and John Hopcroft 2 Jun. 1969 30 p refs
(Contract F19628-67-C-0008)
(AD-693585; TM-738/054/00; SR-27; AFCRL-69-0308) Avail: CFSTI CSCL 5/7

An Abstract Family of Languages(AFL) is a family of sets of words closed under six basic operations. It is shown that a certain family of homomorphic images of sets in an AFL is an AFL. Then two families of sets related to tape-bounded nondeterministic Turing acceptors are shown to coincide and be an AFL. Author (TAB)

N70-11593# System Development Corp., Santa Monica, Calif.
ABSTRACT FAMILIES OF DETERMINISTIC LANGUAGES
William J. Chandler 5 May 1969 79 p refs
(Contract F19628-67-C-0008; Grant AF-AFOSR-1203-67A)
(AD-693577; TM-738/052/00; SR 25) Avail: CFSTI CSCL 5/7

An abstract family of deterministic languages (AFDL) is defined herein as a family of languages closed under marked union, and inverse marked generalized sequential machine (a generalized sequential machine with a right endmarker) mapping. The notion of an abstract family of (one-way) deterministic acceptors (AFDA) is defined. The main result is that a family of languages is an AFDL if only there exists and AFDA which accepts exactly that family of languages. Thus the main result provides a characterization of the family of languages accepted by one-way deterministic acceptors in terms of certain closure properties. Certain subfamilies of AFDA with restructions on either the number of epsilon-moves or the length of the auxiliary memory are shown to yield AFDL. Finally it is shown that the three operations defining an AFDL are mutually independent. Author (TAB)

N70-11598# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A PROGRAMMING LANGUAGE BASED ON A METHOD OF LIBRARY SUB-PROGRAMS
V. I. Sobelman 10 Jul. 1969 13 p refs Transl. into ENGLISH from Tsifroya Vychislitelnye Tekhn. i Programirovanie (USSR), no. 3, 1967 p 18-28
(AD-693594; FTD-HT-23-933-68) Avail: CFSTI CSCL 9/2

An automatic programming language developed on the basis of the library subroutine method is presented. The routine in this language represents a chain of operators of one of the following three types: assignment, procedure, and instruction. With the aid of an assignment operator new values of variables, array, and table elements are determined. The procedure operator is used primarily for setting up the operations carried out by means of library subroutines, and secondarily for carrying out operations on the basis of standard subroutines provided by the translator. TAB

N70-11618# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IMPROVEMENT OF TRANSISTOR CODE PRACTICE DEVICE
Ching-piao Hsieh 16 Jul. 1969 4 p Transl. into ENGLISH from Wu Hsien Tien (Mainland China), v. 10, 1965 p 29
(AD-693598; FTD-HT-23-1297-68) Avail: CFSTI CSCL 17/2.1

The paper suggests some renovation for a transistor radio-signal transmission exercising device proposed in an article appearing in Wu-hsien-tien, pointing out some of the short-comings of that device. The renovation calls for simplifying the circuit of the old device, and reducing the voltage. This makes it possible to place the whole device into a transistor radio case, so that it can be carried by the user. Technical drawings showing the difference of the old and new devices are given. TAB

N70-11696# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SCIENTIFIC AND TECHNICAL CONFERENCE ON NUCLEAR RADIOELECTRONICS
G. P. Melnikov 1 Jul. 1969 19 p Transl. Shestoy Nauchn. Tekhn. Konf. Po Yadernoy Radioelektronike. Tr. (Russian), v. 3, pt. 1, 1965 p 26 – 37
(AD-693523; FTD-HT-23-204-68) Avail: CFSTI CSCL 9/2

Contents: A method of pulse potential diagrams in selecting logic circuits for digital devices; Intermediate storage with content-determined access; and Preliminary processing of data in analog form. TAB

N70-11701# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.
COMPUTER SCIENCES vs SOFTWARE ENGINEERING
Franklin F. Kuo Jul. 1969 7 p ref
(Contract F44620-69-C-0030)
(AD-693622; THEMIS-A69-4; AFOSR-69-2027-TR) Avail: CFSTI CSCL 5/9

The paper is an editorial written for COMPUTER DECISIONS which advances the thesis that computer science departments in the U. S. are not fulfilling the needs of the software industry. A new program is proposed called software engineering to fill the void. Software engineering stresses the pragmatic side of computer systems design and could be established as an independent program with either existing electrical engineering or computer sciences departments. Author (TAB)

N70-11716# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PATTERN-RECOGNITION METHODS APPLIED TO THE PROBLEM OF NOISE-PROOF DECODING
V. A. Andreev et al 17 Jul. 1969 9 p refs Transl. into ENGLISH from Tr. Politekhn. Inst. (Leningrad), no. 275, 1967 p 43 – 48
(AD-693495; FTD-HT-23-527-68) Avail: CFSTI CSCL 9/4

The problem of noise-proof decoding is considered as a particular case of pattern recognition. The use of a perceptron as a decoder in a binary symmetric channel is substantiated. An algorithm is developed which generalizes the nearby elements of the input space and which can be realized by threshold elements. A system composed along these lines was simulated on an Ural-2 digital computer. With a constant norm of output vectors, the mathematical expectation of the decision-function argument, in the elementary perceptron, behaves like a decreasing function of the code distance; hence, the perceptron is suitable for operation as a decoder in a temperature-receiver system. Sixteen standard code vectors were selected for the verification of noise rejection of an experimental recognition system. These vectors were used for teaching the simulated (on the computer) perceptron. The perceptron structure (parameters, ties) may be optimized to solve a concrete problem. Thus, a tentative scheme composed of dynamic neurons seems promising for correcting multiple random independent errors. TAB

N70-11724# RAND Corp., Santa Monica, Calif.
THE SIMSCRIPT 2 PROGRAMMING LANGUAGE: IBM 360 IMPLEMENTATION
P. J. Kiviat, H. J. Shukiar, J. B. Urman, and R. Villanueva Jul. 1969 51 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-692695; RM-5777-PR) Avail: CFSTI CSCL 9/2

The memorandum, a supplement to the users manual (AD-678 690), describes the implementation of SIMSCRIPT II on Rands 360/65 computer. The error codes issued during compilation and during execution are listed and their meanings explained. The first section of this manual contains modifications to AD-678 690 and can only be used in conjunction with it; it identifies the statements that are not yet implemented. Other sections give the rules and deck setup for compilation, assembly, and execution; ways to define additional data sets; calling assembler language routines; storage allocation during execution; random number generation and statistical functions; and directions for installing the compiler, including a listing of JCL that can be used to load the library, compiler, and assembly interface and to punch off the SIMSCRIPT II macros, distributed procedures, and sample program. TAB

N70-11748# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME RESULTS OF USING TWO BESM-2 COMPUTERS
N. P. Zagumennov 22 May 1969 8 p Transl. into ENGLISH from Tsifrovaya Vychislitelnaya Tekhn. i Programmirovanie (USSR), no. 2, 1967 p 91 – 98
(AD-693605; FTD-HT-23-45-69) Avail: CFSTI CSCL 9/2

The article generalizes some data accumulated during a period in which two BESM-2 vacuum-tube computers were used. Data are given about the organization of preventive maintenance for the computers, the number and causes of breakdowns, and some improvements in the computer circuits and in the organizations of their use. Author (TAB)

N70-11774# Forsyth Dental Center, Boston, Mass.
ON THE DETERMINATION OF SYSTEM DYNAMICS
Sidney Lees Feb. 1969 82 p refs
(Contract N00014-67-C-0268)
(AD-693638) Avail: CFSTI CSCL 14/2

Pulse testing is a technique for determining the dynamic properties of systems. Its main advantages are minimization of the time for performing the test and reduced cost for the whole process. The objective of the research program has been to determine how to extract more useful and reliable information from pulse tests. Two data reduction techniques have been shown to be useful and a number of others have been demonstrated not to be useful. Numerical Fourier transforms can be calculated if sufficient data is available. The other data reduction technique is the inversion of the convolution integral. Author (TAB)

N70-11818# Lincoln Lab., Mass. Inst. of Tech., Lexington.
M-ARY CHANNEL QUANTIZATION FOR SEQUENTIAL DECODING
Rein Teoste 20 Aug. 1969 20 p refs
(Contract AF 19(628)-5167)
(AD-693196; TN-1969-45; ESD-TR-69-213) Avail: CFSTI CSCL 9/4

Sequential decoding with direct quantization of the M orthogonal channel outputs is investigated. The rate below which sequential decoding computations are manageable, is computed for a memoryless, coherent, gaussian channel. These computations show the direct quantization to be more effective than the list-of-l quantization, when sufficient storage is available in the decoding device. The performance of a continuous output channel can be approached by quantizing each output to only a few bits. The direct quantization of channel outputs also simplifies the cumbersome computations which would result if list-of-l decoding were implemented in a general purpose computer. Author (TAB)

N70-11850# Michigan Univ., Ann Arbor. Systems Engineering Lab.

PROBABILISTIC ASPECTS OF MACHINE STRUCTURE TEHORY Technical Report, Aug. 1965 - Jan. 1968

Ginafranco R. Putzolu Aug. 1969 99 p refs

(Contract AF 30(602)-3546)

(AD-693641; SEL-TR-26; RADC-TR-69-255) Avail: CFSTI CSCL 9/2

Structure theory of sequential machines deals with the problems of how sequential machines can be realized from smaller component machines and how information flows in and between these machines when they operate. In this report structure theory is examined from a probabilistic point of view. One is interested in questions such as: Given a family of machines, how often would one expect a machine in the family to have a certain structural property. Machine decomposition is analyzed along these lines. Similar results are obtained for various other structural properties. TAB

N70-11851*# Arizona Univ., Tucson. Engineering Experiment Station.

ANALOG, HYBRID, AND DIGITAL SIMULATION

[1968] 55 p refs Sponsored by NASA

(NASA-CR-106771; EES-SR-16) Avail: CFSTI CSCL 09B

CONTENTS:

1. MONTE CARLO SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS USING A HYBRID COMPUTER H. Handler 8 p refs (See N70-11852 02-19)

2. CORRELATION METHOD FOR COMPUTING SENSITIVITY FUNCTIONS ON A HIGH-SPEED ITERATIVE ANALOG COMPUTER Em P. O'Grady 7 p refs (See N70-11853 02-19)

3. STATE-SPACE METHODS FOR DESIGNING DIGITAL SIMULATIONS OF CONTINUOUS FIXED LINEAR SYSTEMS J. V. Wait 4 p refs (See N70-11854 02-19)

4. EXPERIMENTS WITH DIGITAL COMPUTER SIMULATIONS OF PSEUDO-RANDOM NOISE GENERATORS R. C. White, Jr. 3 p refs (See N70-11855 02-10)

5. A NEW DIGITAL ATTENUATOR SYSTEM FOR HYBRID COMPUTERS C. P. Pracht 9 p refs (See N70-11856 02-08)

6. HYBRID ANALOG-DIGITAL SAMPLE-AVERAGING COMPUTER FOR ASTRAC II R. L. Maybach 7 p refs (See N70-11857 02-19)

7. REMARKS AT THE TENTH ANNIVERSARY OF THE INTERNATIONAL ANALOG COMPUTER ASSOCIATION, FEBRUARY 1966 G. A. Korn 2 p (See N70-11858 02-08)

8 APE II: A MODERN ANALOG/HYBRID COMPUTER FOR LABORATORY INSTRUCTION G. A. Korn 8 p refs (See N70-11859 02-08)

9. MODERN DIGITAL CONTROL FOR A SMALL ITERATIVE ANALOG COMPUTER: THE APE II DIGITAL MODULE B. K. Conant 6 p refs (See N70-11860 02-08)

N70-11856*# Arizona Univ., Tucson. Dept. of Electrical Engineering.

A NEW DIGITAL ATTENUATOR SYSTEM FOR HYBRID COMPUTERS

Conrad Paul Pracht *In its* Analog, Hybrid, and Digital Simulation 1968 9 p refs (See N70-11851 02-08)

Avail: CFSTI CSCL 09B

This report describes a new digital attenuator system employing low-phase-shift miniature metal-film ladder networks. They are switched by latching reed relays which give the system a nondestructive coefficient memory even when the computer is switched off. New digital control logic employs serial data transmission and requires only one address line per 14-bit attenuator. It permits one to set all 200 attenuators of a typical hybrid computer installation within 20 milliseconds. For maximum contact life, relay contacts are switched only when no current is flowing. The digital computer static-check routine can readily check individual relays to simplify maintenance. Particular emphasis in this report is on a digital-attenuator system designed for a very fast repetitive computer. The same design approach is readily applied to "slow" analog computers and appears to be even more advantageous there. Author

N70-11858*# Arizona Univ., Tucson. Dept. of Electrical Engineering.

REMARKS AT THE TENTH ANNIVERSARY OF THE INTERNATIONAL ANALOG COMPUTER ASSOCIATION, FEBRUARY 1966

Granino A. Korn *In its* Analog, Hybrid, and Digital Simulation 1968 2 p (See N70-11851 02-08)

Avail: CFSTI CSCL 09B

The development of analog and hybrid-analog/digital computation is intimately bound up with the corresponding progress of digital computation. The integrated-circuit revolution is producing excellent flexible and fast digital computers; at the same time, larger digital computers are conveniently time-shared by many users through multiple stations. Coupled with ever-increasing digital-computer speeds, both methods increasingly permit direct intercourse between man and digital computer, an advantage heretofore reserved for analog computers. Combined simulation with analog and digital computers is now an accepted simulation technique. Particularly fortunate combinations involve an analog computer and a relatively small digital computer working only once per analog-computer run to implement optimization routines and to take statistics: the digital computer also performs analog housekeeping functions, such as the setting of potentiometers (or, to an increasing extent, of digitally switched resistor networks replacing the latter), static-checks, function-generator setting, and scale-factor determination. Author

N70-11859*# Arizona Univ., Tucson. Dept. of Electrical Engineering.

APE II: A MODERN ANALOG/HYBRID COMPUTER FOR LABORATORY INSTRUCTION

Granino A. Korn *In its* Analog, Hybrid, and Digital Simulation 1968 8 p refs (See N70-11851 02-08)

Avail: CFSTI CSCL 09B

The APE II computer system comprises a 12-amplifier solid-state analog computer capable of both real-time and repetitive operation, and a digital-logic module with patchable digital logic. A flexible digital clock generates computer-reset and sampling pulses. Random and pseudo-random noise generators and digital readout counters permit a wide variety of statistical studies as well as simulation experiments with sampled-data control systems, automatic optimization, boundary-value problems, and simple combined analog-digital computation at minimum cost. Special experiments can be stored on removable patchboards. Perhaps the most interesting technical feature of the new computer is its novel packaging technique: amplifier and integrated-circuit logic cards plug directly into the rear of the inexpensive patchbay receivers, which serve, thus, as card cages and save much inter-unit wiring. Author

N70-11860*# Arizona Univ., Tucson. Dept. of Electrical Engineering.

MODERN DIGITAL CONTROL FOR A SMALL ITERATIVE

ANALOG COMPUTER: THE APE II DIGITAL MODULE
Brian K. Conant *In its* Analog, Hybrid, and Digital Simulation 1968 refs 6 p (See N70-11851 02-08)
Avail: CFSTI CSCL 09B

The APE II computer system is a small solid-state iterative differential analyser designed for laboratory instruction and is capable of both repetitive and real-time operation. This paper describes the APE II digital module, which includes a master clock for generating reset and sampling pulses, random and pseudo-random noise generators, digital counters and free patchable digital logic. This module, when used with the APE II analog module or similar small analog computers, permits a very wide variety of hybrid simulation and statistical experiments. Author

N70-11868# Sandia Labs., Livermore, Calif.
A TECHNIQUE FOR COMPUTING THE DISCRETE FOURIER TRANSFORM OF LONG TIME SERIES
R. E. Humphrey Jul. 1969 32 p refs
(Contract AT (29-1)-789)
(SCL-DR-69-73) Avail: CFSTI

This report describes a technique that can be used to compute the discrete Fourier transform of a very long time series. Time domain decimation of the data is used to obtain subseries which are of sufficiently short length that their discrete Fourier transforms can be computed using a so-called fast Fourier transform subroutine. The transformed series are then decimated to place the sequence of values in a convenient order for recombination. After recombination, decimation is used once again to reorder the data. A digital computer program that utilizes this technique has been written in FORTRAN language for the CDC 3600 computer and is included in the Appendix. Author (NSA)

N70-11922# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A DEVICE FOR TRANSMITTING AND RECEIVING DELTA-MODULATED DATA WITH ERROR CORRECTION
G. M. Kozyreva 1 Jul. 1969 4 p Transl. into ENGLISH from Russian Patent no. 196936 (Appl. no. 1058151/26-24, 19 Feb. 1966) 2 p
(AD-693593; FTD-HT-23-237-68) Avail: CFSTI CSCL 9/2

The invention involves a system for the transmission and reception of modulated data with error correction. The system contains a modulator, a coding device, a communication channel, a demodulator, and a correction-forming unit. To increase the speed of operation, the system is equipped with a distributor of column groups for information and control, which is connected to the output of the coding device, whose output is connected to the communication line. Author (TAB)

N70-11928*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA INFORMATION SYSTEM AT THE NATIONAL SPACE SCIENCE DATA CENTER
Nick Karlow and James I. Vette Sep. 1969 21 p refs Presented at the ASIS Ann. Conv., San Francisco, 1-4 Oct. 1969
(NASA-TM-X-63739; X-601-69-416) Avail: CFSTI CSCL 05B

The National Space Science Data Center (NSSDC) developed an integrated information system to support its data handling activities. A brief discussion is given of the information system, which is comprised of four main subsystems: the automated internal management file, the machine-oriented data system, the technical reference file, and the request accounting status and history file. This system satisfies current operational requirements; however, it must grow to meet future needs. Considerations include: new and better software and hardware, orderly retirement of data with and without loss of information content, and experimenter on-line interactions to data held at NSSDC. Author

N70-12051# Advisory Group for Aerospace Research and Development, Paris (France).
STORAGE AND RETRIEVAL OF INFORMATION: A USER-SUPPLIER DIALOGUE
H. F. Vessey (RADC) and I. J. Gabelman, eds. (Min. of Technol., UK) Jun. 1968 191 p refs Conf. held at Munich, 18-30 Jun. 1968
(AGARD-CP-39) Avail: CFSTI

CONTENTS.

1. COMMUNICATION AND SECRECY IN SCIENCE R. Schrader (Ministry of Defence, W. Ger.) p 1-10 (See N70-12052 02-08)

2. THE SUPPLIER'S POINT OF VIEW, INTRODUCTORY PAPER H. F. Vessey (Ministry of Tech., London, Engl.) p 11-20 (See N70-12053 02-08)

3. THE PROBLEMS POSED BY DOCUMENTARY VOCABULARY AND THE ORGANIZATION OF DICTIONARIES AND THESAURI F. Levery (IBM, Paris, France) p 21-40 (See N70-12054 02-08)

4. FOUR NEW SCIENCES: AN APPROACH TO COMPLEXITY E. B. Montgomery (Syracuse Univ.) p 41-48 (See N70-12055 02-07)

5. TRENDS AND DEVELOPMENTS IN CHARACTER AND PATTERN RECOGNITION L. A. Feldelman (Auerbach Corp., Philadelphia, Pa.) p 49-62 refs (See N70-12056 02-08)

6. EFFICIENT TRANSFER OF TEXTUAL INFORMATION J. W. Altman (Am. Inst. for Res., Pittsburgh, Pa.) p 63-76 refs (See N70-12057 02-08)

7. ON-LINE INFORMATION STORAGE AND RETRIEVAL N. S. Prywes (Pa. Univ.) p 77-88 refs (See N70-12058 02-08)

8. NON-NUMERICAL MATHEMATICS AND DATA PROCESSING F. Krueckeberg (Bonn Univ., W. Ger.) p 89-98 refs (See N70-12059 02-19)

9. MANUAL SYSTEMS: TDCK CIRCULAR THESAURUS SYSTEM J. A. Schueller (Tech. Doc. en Informatie Centrum Voor de Krijgsmacht, The Hauge, Neth.) p 99-110 (See N70-12060 02-08)

10. MECHANICAL SYSTEMS N. E. C. Isotta (ESRO, Paris, France) p 111-116 (See N70-12061 02-08)

11. AN INTRODUCTION TO THE STUDY OF COST EFFECTIVENESS IN INFORMATION SYSTEMS J. N. Wolfe (Edinburgh Univ., Scot.) p 117-122 (See N70-12062 02-08)

12. TECHNICAL INFORMATION SERVICES AND USER NEEDS W. C. Christensen (Defense Dept., Washington, D.C.) p 123-132 (See N70-12063 02-08)

13. SELECTIVE DISSEMINATION OF INFORMATION M. S. Day (NASA., Washington, D.C.) p 133-150 (See N70-12064 02-08)

14. INTERACTIVE INFORMATION PROCESSING, RETRIEVAL, AND TRANSFER J. R. C. Licklider (MIT, Cambridge) p 151-168 refs (See N70-12065 02-08)

15. MAN-MACHINE INTERFACE W. Haendler (Erlangen-Nuremberg Univ., W. Ger.) p 169-178 (See N70-12066 02-08)

16. EDUCATION F. Liebesny (Brit. Aluminum Co., Ltd., London, Engl.) p 179-186 refs (See N70-12067 02-08)

N70-12052# Ministry of Defence, (West Germany).
COMMUNICATION AND SECRECY IN SCIENCE
R. Schrader *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 p 1-10 (See N70-12051 02-08)
Avail: CFSTI

The increasing volume of material published is giving rise to the use of computers in assembling, processing and indexing of research results. Experience shows that however modern the computer it can never make critical judgement or interrogation of the data it handles. Direct contact (by correspondence, discussions, conferences) will continue to play a major role in communication. Secrecy, whether military or industrial, is always to be deprecated from the viewpoint of scientific research and should never be applied to pure research and broad fields of basic knowledge. Secrecy

can only bring short term advantages. Finally, recommendation made by the NATO Science Committee on exchanges of scientific information, cooperation in publication and coordination of documentation centers are recalled. Author

N70-12053*# Ministry of Technology, London (England).
THE SUPPLIER'S POINT OF VIEW, INTRODUCTORY PAPER
H. F. Vessey *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 p 11–20 (See N70-12051 02-08)
Avail: CFSTI

The tasks, problems and equipment available to the documentalist or information officer are outlined. The types of information agencies, libraries, documentation centers, information analysis centers and referral centers, and the services each provides, are briefly described. The economic need to link information retrieval by computer with other activities, such as preparation of abstract journals, indexes, and SDI, is stressed. Future developments in photographic methods of storing text, preparation of reports on tape, machine reading of texts, remote display, rapid printing techniques, and education of documentation service users are discussed. Author

N70-12054# International Business Machines Corp., Paris (France).
THE PROBLEMS POSED BY DOCUMENTARY VOCABULARY AND THE ORGANIZATION OF DICTIONARIES AND THESAURI [LES PROBLEMS POSES PAR LE VOCABULAIRE DOCUMENTAIRE ET L'ORGANISATION DES DICTIONNAIRES ET THESAURUS]
F. Lavery *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 p 21–40 In FRENCH; ENGLISH summary (See N70-12051 02-08)
Avail: CFSTI

The compilation of documentary card indexes implies that the information contained in a text can be characterized by means of a certain number of signs. The overall signs used and available make up a documentary vocabulary serving two purposes: on the one hand, characterizing texts (analysis of subject matter); on the other hand, expressing documentary research. To fulfill both tasks, documentary vocabulary must be extensive (accuracy of representation) and structured (research strategy). Structured documentary dictionaries, or thesauri, appear to be the indispensable link between authors and people requesting information. A few practical methods for achieving such thesauri are presented. Author

N70-12056# Auerbach Corp., Philadelphia, Pa.
TRENDS AND DEVELOPMENTS IN CHARACTER AND PATTERN RECOGNITION
L. A. Feldelman *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 p 49–62 refs (See N70-12051 02-08)
Avail: CFSTI

Up-to-date developments in the fields of pattern and character recognition are described, and technical and economic possibilities for the near future are forecase by surveying present technical principles, present and potential areas of application, and significant trends. It is indicated that although character and pattern recognition are based on the same techniques, their areas of application are quite diverse. Character recognition techniques have been incorporated into commercially acceptable computer peripheral equipment in the form of character readers, whereas pattern recognition work is still in the experimental stage. Author

N70-12057# American Inst. for Research, Pittsburgh, Pa.
EFFICIENT TRANSFER OF TEXTUAL INFORMATION
J. W. Altman *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 p 63–76 refs (See N70-12051 02-08)
Avail: CFSTI

Three problems which arise in attempts to achieve efficient provision of textual information to scientists and engineers are defined: (1) Text-sensitive tasks of scientists and engineers have not been delineated and analyzed sufficiently to define clearly their requirements for textual information support. (2) Methods have not yet been established to permit characterization of text in terms which support the development of a technology for efficient transfer of text to users. (3) Little concentrated effort has been put into attempts to establish lawful relationships between text-sensitive tasks and characteristics of text. Ways of tackling these problems are suggested. Author

N70-12058# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
ON-LINE INFORMATION STORAGE AND RETRIEVAL
N. S. Prywes *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 p 77-88 refs (See N70-12051 02-08)
(Contract Nonr-551(40))
Avail: CFSTI

The components of an automatic storage and retrieval system are briefly reviewed. The storage process consists of transcription of bibliographic detail, and sometimes abstracts, into machine readable form, generation of a thesaurus, and automatic indexing of documents using this thesaurus. Finally, an automatic process may be applied which generates a library classification system for the collection. The interactive man-computer retrieval process, which follows the storage process, offers the best potential for improving retrieval effectiveness. The user may search thesauri, classification schedules, catalogues, or the documents, in a manner very similar to that employed traditionally in libraries but with far less effort and at much greater speed. Author

N70-12060# Techniach Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
MANUAL SYSTEMS: TDCK CIRCULAR THESAURUS SYSTEM
J. A. Schueller *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 p 99–110 (See N70-12051 02-08)
Avail: CFSTI

The organization, functions, and systems used at TDCK are described. The TDCK collects, evaluates, and stores information primarily useful for military purposes. The retrieval systems used are Universal Decimal Classification and the TDCK-Compact System. The TDCK Thesaurus has been designed such that related concepts are placed on concentric circles: arrows, fanning out in all directions, are used to display relationships between the descriptors. The input coding will start from the center of the circle, following an arrow until the wanted descriptor is reached. A total of 376 circle-schemes have been designed so far. Author

N70-12061# European Space Research Organization, Paris (France).
MECHANICAL SYSTEMS
N. E. C. Isotta *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 p 111–116 (See N70-12051 02-08)
Avail: CFSTI

The view is put forward that the handling of large document files requires mechanization and that even processes such as document analysis for input, question analysis for retrieval, and retrieval result evaluation, must eventually succomb to machine treatment. Keypunching of computer input presents particular problems. The solution could be optical scanning if standardized print formats were used in document production. The direct interrogation of the machine file by remote visual display consoles is an inevitable development. The ESRO/ELDO Documentation Service

hopes to have a system available in Europe early in 1969. Ultimately such consoles would be installed at strategic points throughout the European network of ESRO establishments. Author

N70-12082# Edinburgh Univ. (Scotland).
AN INTRODUCTION TO THE STUDY OF COST EFFECTIVENESS IN INFORMATION SYSTEMS.
J. N. Wolfe *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 p 117–122 (See N70-12051 02-08)
Avail: CFSTI

Observations on the nature of cost effectiveness studies in general are made as an introduction to the procedures being adopted in a study of information services commissioned by the Office of Scientific and Technical Information, UK. Cost determination for alternative types of service is the first step in the procedure. The replacement of an old information service by a new type and the situations in which two alternative types of service exist side by side are evaluated. Finally, the services provided by alternative information systems must be evaluated. Author

N70-12083# Defense Dept., Washington, D.C.
TECHNICAL INFORMATION SERVICES AND USER NEEDS
W. C. Christensen *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 p 123–132 (See N70-12051 02-08)
Avail: CFSTI

Three audiences for technical information are defined: the general audience, the mission audience, and the technical management audience. The information needs of these three groups are discussed. The provision of technical information by the U.S. Department of Defense is outlined and, in particular, some of the functions of the Defense Documentation Center are described. Author

N70-12084*# National Aeronautics and Space Administration, Washington, D.C.
SELECTIVE DISSEMINATION OF INFORMATION
M. S. Day *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 p 133–150 (See N70-12051 02-08)
Avail: CFSTI CSCL 05B

Selective Dissemination of Information (SDI) provides individual scientists and engineers with announcements of a limited number of documents specifically of interest to them, in contrast to the general coverage provided by increasingly bulky abstract journals. Selection is done by a computer program, which compares a file of bibliographic data on current reports and journal literature with an SDI user's interest profile, then prints out references to matching documents. The selected references may be presented to the user on cards suitable for filing or on less expensive printed lists, and may provide only the document citation or the full abstract. Feedback by the user on the relevance of the documents helps to optimize his interest profile for best selection. Comparison of numerous individual interest profiles is expensive in computer time, and profile improvement requires assistance by vocabulary specialists. Economical service to large numbers of participants may be provided by the use of standard subject profiles, as typified by the NASA/SCAN (Selected Current Aerospace Notices) program which is described. Author

N70-12085# Massachusetts Inst. of Tech., Cambridge.
INTERACTIVE INFORMATION PROCESSING, RETRIEVAL, AND TRANSFER
J. R. C. Licklider *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 p 151–168 refs (See N70-12051 02-08)
(Contract Nonr-4102(01))
Avail: CFSTI

Details are given on the present status and trends of man–computer–interactive information processing, retrieval, and transfer made possible by multi-access computers. Some of the promises and problems of interaction are examined. The main activity in this field in the U.S.A. is the development of hardware–software systems and subsystems. Examples are drawn from three projects: MAC, TIP, and Intrex at the Massachusetts Institute of Technology. Author

N70-12086# Erlangen-Nuremberg Univ. (West Germany).
MAN-MACHINE INTERFACE
W. Haendler *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 p 169–178 (See N70-12051 02-08)
Avail: CFSTI

The problem of the man-machine interface is traced back to the time when the first computers were designed. In overcoming the problems of the interface the cathode-ray tube display is of prime importance. Using the display screen it is possible to transmit almost instantaneously to man alphanumeric text, black and white shading, scaled shading, colored pictures, and moving pictures. The mathematical theory of automata is opening up new ways of examining the problems in a formal manner. Solution to many of the problems at the interface, however, still awaits better knowledge of how information processing takes place within the human nervous system. Author

N70-12087# British Aluminum Co., Ltd., London (England).
EDUCATION
F. Liebesny *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 refs p 179–186 (See N70-12051 02-08)
Avail: CFSTI

The educational requirements for users and suppliers of scientific and technical information and the steps taken to provide professional education for various levels of attainment are discussed. Mention is made of specific efforts made in the U.K. to provide undergraduate and postgraduate training for users. The types of training courses available to suppliers (chartered librarians, library assistants and information scientists) are outlined. Author

N70-12075# Los Alamos Scientific Lab., N.Mex.
RDTRAN: MACHINE-DEPENDENT MODIFICATIONS FOR THE CDC-6600
Roger D. Mc Daniel and James H. Griffin 10 Jan. 1969 23 p refs
(Contract W-7405-eng-36)
(LA-4020-Suppl-1) Avail: CFSTI

RDTRAN is a computer program for translating and processing free format input data. It is an interpretive system designed for use as the input translator of a problem-oriented source language, or as a general purpose free format input loader. This is a supplement to LASL report LA-4020 and contains a source language listing of the machine-dependent modifications for the CDC-6600. Author (NSA)

N70-12089# California Univ., Berkeley. Lawrence Radiation Lab.
INEXPENSIVE MAGNETIC TAPE FOR SMALL COMPUTER USE
M. A. Lechaczynski and L. B. Robinson Jun. 1969 33 p refs
(Contract W-7405-eng-48)
(UCRL-19230) Avail: CFSTI

An inexpensive magnetic tape system for a small computer (SCC 650, 4K, 12 bit), using a DECTAPE transport TU55. This system will also be connected to a larger computer (SCC 660, 16K, 24 bit). Author (NSA)

N70-12123# Los Alamos Scientific Lab., N.Mex.
EPUT MULTIPLEXER CODER DRIVER AND THE EPUT MULTIPLEX DECODER
Ralph R. Fullwood 1 May 1969 5 p
(Contract W-7405-eng-36)
(LA-4175-MS) Avail: CFSTI

The EPUT Multiplexer Coder Driver sequentially measures

the events per unit time (EPUT) of a maximum of 10 input channels for a period of 0.1 or 1.0 sec. It displays the count and the channel identification for 1, 2, or 4 sec and serially shifts what had been displayed onto a voice grade telephone line in a BCD code together with shift bits. This is decoded and displayed at a remote location by the EPUT Multiplex Decoder. It is also capable of fixed channel operation. Author (NSA)

N70-12208*# System Development Corp., Santa Monica, Calif.
ON-LINE PARSING OF HAND-PRINTED MATHEMATICAL EXPRESSIONS Final Report for Phase 2
Thomas G. Williams Washington NASA Dec. 1969 17 p
(Contracts NAS12-526; DHCH15-67-C-0149)
(NASA-CR-1455; TM-4158/000/00) Avail: CFSTI CSCL 09B

This document describes a program which analyzes free-hand two-dimensional mathematical expressions. The user interacts with the character recognizer to enter characters of any size placed anywhere on the input surface. His hand-printed characters, as recognized, are replaced in a standard form at the same place, same size, same aspect ratio by the character recognizer. The output of the analyzer is also displayed at the top of the writing surface so that the user knows the current interpretation of his input. The analysis or parsing program is a two-phase system. The first phase converts the two-dimensional structure into a linear string. This phase operates concurrently with input and editing, so that the user can always be given the current interpretation of his input. The string also provides editing information. The second phase operates on the linear string in the same manner as a conventional compiler or interpreter. It is dependent upon the ultimate objective of the input, and thus will not be discussed here. Author

N70-12246*# Martin Marietta Corp., Denver, Colo.
A STUDY PROGRAM ON THE DEVELOPMENT OF MATHEMATICAL MODEL (S) FOR MICROBIAL BURDEN PREDICTION. VOLUME 8: TECHNICAL REPORT, PHASE 7 AND REVISED USER'S MANUAL FOR THE MICROBIAL BURDEN PREDICTION MODEL Final Report Addendum
Oct. 1969 93 p refs Prepared for JPL
(NAS7-100; JPL-952532)
(NASA-CR-106997; MCR-68-97-Vol-6) Avail: CFSTI CSCL

Computer programs for the microbial burden prediction model were revised. The following improvements were made: (1) daily restarts, allowing new data to be incorporated to update previous estimates, (2) alteration of data on tapes to avoid working with the card deck, (3) faster running, by using histograms for burden calculations, and (4) printout options, for reduction of paper volume and printout time. With some modifications, the computer programs were checked out on the Univac 1108. A prediction for Mariner Venus 67-2 spacecraft was generated. Phase 7 and 6 prediction mean values were compared at two points during the runs and differences were noted which were attributed to an error in the burden prediction model. Recommendations for program continuation are briefly discussed. J.A.M.

N70-12272*# IIT Research Inst., Annapolis, Md. Systems Sciences Research Div.
RETRIEVAL INFORMATION FILE RELATING TO ASSIGNED FREQUENCIES, PART 2 Final Report, Jan. - Sep. 1969
Peter Bock and Norbert M. Katz Oct. 1969 69 p
(Contract NAS12-639; IITRI Proj. X6908)
(NASA-CR-86269; IITRI-X6908-F-Pt-2) Avail: CFSTI CSCL 09B

Retrieval from the International Frequency Assignment Files (RIFRAF) is a computer program written in COBOL and currently operating on an IBM 360/30 computer. The function of RIFRAF is to serve as a useful retrieval tool for the investigation of registerad international telecommunications installations. A brief outline of the computer program structure is given, and a limited test file was established. Authdr

N70-12392# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
COMPUTER PROGRAMS FOR HARMONIC ANALYSIS AND SYNTHESIS OF TABULAR DATA
C. A. Oster Jun. 1969 68 p refs
(Contract AT(45-1)-1830)
(BNWL-1124) Avail: CFSTI

Three algorithms for the harmonic analysis and synthesis of tabular data are described. A brief discussion of the underlying theory of Fourier series approximation, the Fourier transform of such a series, and a method of inverting such a transform is included. These procedures have been coded as subprograms in FORTRAN V. A program using these subprograms is described. Also, listings of all routines under discussion as well as sample input and the resulting output are presented. Author (NSA)

N70-12405# National Bureau of Standards, Washington, D.C.
CALIBRATION OF NBS SECONDARY STANDARD MAGNETIC TAPE (COMPUTER AMPLITUDE REFERENCE) REFERENCE TAPE AMPLITUDE MEASUREMENT 'PROCESS A'
Sidney B. Geller, Paul A. Mantek, and Norman G. Cleveland Nov. 1969 44 p *Its* Spec. Publ. no. 260-18
Avail: SOD $0.50

This publication describes the design and operation of the NBS signal amplitude measuring system (Process A) that is used for calibrating unrecorded secondary standard magnetic tapes (computer amplitude reference). The signal level calibration is made with respect to a reference signal level derived from the NBS master standard magnetic tape (computer amplitude reference) that is kept in repository at NBS. The techniques for measuring and recording the data that accompany each secondary standard magnetic tape in the form of strip chart recordings and saturation curves are described. Author

N70-12426# Union Carbide Corp., Oak Ridge, Tenn.
XSDRN: A DISCRETE ORDINATES SPECTRAL AVERAGING CODE
C. W. Craven, Jr. Jul. 1969 134 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2500) Avail: CFSTI

XSDRN is a discrete ordinates spectral code for the generation of nuclear multigroup constants in the fast, resonance, and thermalization energy regions. A variable dimensioning technique is employed which optimizes the use of core storage. The code calculates an arbitrary number of flux moments for zero or one-dimensional systems. Several problem types are provided for, including fixed source, eigenvalue, and criticality search. Extensive cross section libraries are available which can be reduced, using calculated fine-group fluxes, to arbitrary broad-group structures. Provisions are available to produce library tapes for several codes, and modifications can be easily made to include other codes. Input/output formats and a program write-up are included. Author (NSA)

N70-12431# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.
THE 7000 SERIES CAMAC CONTROLLERS
J. M. Richards Apr. 1969 22 p
(AERE-M-2145) Avail: HMSO 3s 6d; BIS $0.70; CFSTI

CAMAC is a convenient system for the design of digital instruments, which has been specified by the International ESONE Committee. The 7000 Series of plug-in units is being developed to the CAMAC Specification, by AERE and industry in collaboration. While the operation of the digital units in the 7000 Series has largely been settled by the CAMAC Specification, the method of control and read-out of these modules by computers or other digital hardware has not been closely specified. A description is given of how the control of CAMAC compatible modules is organized in the 7000 Series. Author (NSA)

N70-12451# Naval Weapons Lab., Dahlgren, Va.
SYMBOLIC ALGEBRAIC LANGUAGES, THEIR FORMULATION AND IMPLEMENTATION
Alfred H. Morris, Jr. Aug. 1969 40 p refs
(AD-693101; NWL-TR-2320) Avail: CFSTI CSCL 9/2

In the paper the underlying principles that are involved in the theoretical formulation and implementation of symbolic algebraic languages on the computer are defined and examined. After a brief discussion concerning the initial components of such languages, the major issues that are considered are the use of functional expressions and exponentials, control and modification of the mathematical machinery of the language by its user, and chains of multipurpose models. It is noted that general chains possessing two or more models provide the most desirable environment for allowing the analyst to simplify mathematical expressions containing various types of data polynomials, trigonometric and elliptic functions, etc. The language flap is used for illustrating many of the concepts involved, and their resulting consequences. Author (TAB)

N70-12468# Houston Univ., Tex. Cullen Coll. of Engineering.
STIL USERS MANUAL
Charles E. Donaghey and Osman S. Ozkul Aug. 1969 30 p refs
(Contract N00014-68-A-0151)
(AD-693521; THEMIS-RE-8-69) Avail: CFSTI CSCL 9/2

There are an abundance of statistical programs and subroutines available to the computer user. However, for the occasional computer user, or the beginning statistics student, the use of these programs and subroutines can prove to be quite complex. For this reason STIL (STatistical Interpretive Language) has been developed. This language allows a user to quickly and easily write programs that solve a moderate range of statistical and probability problems. This manual explains the use of the language. Author (TAB)

N70-12516*# Wyle Labs., Inc., Huntsville, Ala. Research Div.
COMPUTER PROGRAMS FOR THE CALCULATION OF DIRECT AND CROSS POWER SPECTRAL DENSITY OF DISCRETE RANDOM DATA
A. C. Jolly Jan. 1969 165 p refs
(Contracts NAS8-21060; NAS8-21026)
(NASA-CR-102368; WR-69-1) Avail: CFSTI CSCL 09B

Four computer programs, designed for use in power spectral density analysis of stationary random data, are described. The programs carry out the estimation of direct and cross power spectral density by the method of direct Fourier transformation using the Fast Fourier Transform algorithm and by the indirect method using the auto or cross correlation functions. A facility, based on low pass digital filtering and data decimation, for varying the analysis bandwidth over the frequency range is included; this facility leads to an efficient method of calculating one third octave band, or other percentage frequency bandwidth, results and a routine for this is included. The programs are written primarily in FORTRAN language, with certain routines which have a major influence on execution time, or which use input/output facilities not available in FORTRAN, written in COMPASS assembly language for the CDC 3300 computer. Full program documentation is included, covering the needs of both program usage and program maintenance. Author

N70-12520# Sandia Corp., Albuquerque, N.Mex.
GERBER FORTRAN PLOTTING PACKAGE
P. W. Plomp Aug. 1969 68 p Sponsored by AEC
(SC-M-69-465) Avail: CFSTI

A users manual for individuals wishing to use the Gerber Series-1000 Automatic Drafting Machine via Fortran computer programs is presented. The subroutines are described which generate the required control media for the Gerber. Author (NSA)

N70-12530# California Univ., Los Angeles. Dept. of Computer Science.
INSTRUMENTING COMPUTER SYSTEMS AND THEIR PROGRAMS
Bertram Bussell [1968] 12 p refs Presented at Pan-Am. Congr. of Mech., Elec., and Appl. Eng., San Juan
(Contracts N00014-67-A-0111; ARPA-SD-184; AT(11-1)-GEN-10)
(UCLA-10-P-14-78; CONF-690904-1) Avail: CFSTI

A research program in computer instrumentation and measurement is described. This program has been developed with an eye toward minimizing artifact in the measuring process. The research is carried on in several phases. In the earliest phase, measurements are made on an object computer with instrumentation programs written in the object computer. These measurements yield instruction mix statistics of all, or any portion, of an object program at the machine language level. Timing measurements of portions of the object program can also be made by calling for appropriate instrumentation packages. The object program can be written at a compiler language level. The second phase reduces artifact by attaching external hardware to the object computer. This equipment acts as an observer of specially generated information signals from within the source program, or from electronic signals generated by sections of the object computer being observed. Author (NSA)

N70-12532*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
CONVOLUTIONAL CODING TECHNIQUES FOR DATA PROTECTION Quarterly Progress Report, 16 May - 15 Aug. 1969
James L. Massey 8 Sep. 1969 26 p refs
(Grant NGL-15-004-026)
(NASA-CR-107118) Avail: CFSTI CSCL 09B

The development of general inverses for linear sequential circuits (LSC's) and continuous dynamical systems (CDS's) is reported. This paper shows how to construct an inverse, where one exists, for an m-input LSC (or CDS) such that each output of the inverse when cascaded with the original system is one of the inputs to the original system delayed by L time units (integrated L times). The investigation has shown that the techniques can be extended to apply to the case when each of the inputs is recovered with individually the least delay (the least integration) rather than with uniform delay (integration). Author

N70-12568# System Development Corp., Santa Monica, Calif.
PRINCIPAL AFL
Seymour Ginsburg and Sheila Greibach 7 Apr. 1969 55 p refs
(Contract F19628-67-C-0008; Grant AF-AFOSR-1203-67)
(AD-693576; Scientific-24, SDC-TM-738/051/00; AFCRL-69-0255) Avail: CFSTI CSCL 5/7

A (full) principal abstract family of languages(AFL) is a (full) AFL generated by a single language, i.e., it is the smallest (full) AFL containing the given language. In the present paper, a study is made of such AFL. First, an AFA (abstract family of acceptors) characterization of (full) principal AFL is given. From this result, many well-known families of AFL can be shown to be (full) principal AFL. Next, a representation theorem for each language in a (full) principal AFL is given involving the generator and one application each of concatenation, star, intersection with a regular set, inverse homomorphism, and a special type of homomorphism. Finally, it is shown that if LL1 and LL2 are (full) principal AFL, then so are (a) the smallest (full) AFL containing (the intersection of L1 and L2/L1 in LL1, L2 in LL2) and (b) the family obtained by substituting epsilon-free languages of LL2 into languages of LL1. Author (TAB)

N70-12581# Akademiya Nauk URSR, Kiev.
ALGORITHM FOR CALCULATING A GENERAL FORMULA FOR INPUT DATA ON A CLASS EQUIVALENT CODES
V. V. Gritsyk and Ya. A. Dubrov *In its* Methods for Collecting and

Process. Inform. 1967 p 43–62 refs In RUSSIAN (See N70-12578 02-34)
Avail: CFSTI

An algorithm is considered which aids in locating a general expression for input information for a class of equivalent restrictive codes. Results have applications in evaluating the effectiveness of binary codes. Transl. by E.C.

N70-12582# Akademiya Nauk URSR, Kiev.
COMPUTERIZED EVALUATION OF INPUT DATA FOR CORRECTING CODES
V. V. Gritsyk and Ya. A. Dubrov *In its* Methods for Collecting and Process. Inform. 1967 p 63–70 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

Flow diagrams are discussed for digital computer processing of a Shannon algorithm and correcting of codes in a binary symmetric channel. For illustration, a formula derived from a Reid–Mueller code is examined. Transl. by E.C.

N70-12584# Akademiya Nauk URSR, Kiev.
CONSTRUCTION AND ANALYSIS OF ORTHOGONAL CHEBYSHEV-TYPE CORRECTOR
V. A. Kisel and V. Ya. Oddesskiy *In its* Methods for Collecting and Process. Inform. 1967 p 87–97 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

Orthogonal corrector circuits are examined in which the transmission coefficient is characterized by segments of a series of even or odd Chebyshev polynomials of the first and second order. Chebyshev correctors for low frequency, feedback, and bandpass filtering systems are analyzed. Transl. by E.C.

N70-12602# Sandia Corp., Albuquerque, N.Mex. Computer-Aided Design Systems Div.
GERBER FORTRAN PLOTTING PACKAGE SYSTEM DESCRIPTION MANUAL
P. W. Plomp Aug. 1969 167 p Sponsored by AEC
(SC-M-69-466) Avail: CFSTI

The Fortran subroutines of the Gerber Fortran Plotting Package are described. The routines are available for usage on the IBM 7090, CDC 3600, CDC 6600 and the UNIVAC 1108. The routines are described as a general computer package, but peculiarities are recorded by computer name. The manual contains a summary of all subroutine calls in the package, a brief description of each subroutine and its purpose, and definition of all variables. Author (NSA)

N70-12662# Joint Publications Research Service, Washington, D.C.
SIMULATION OF COMPLEX SYSTEMS
N. P. Buslenko 6 Nov. 1969 55 p Transl. into ENGLISH from the "Modelirovaniye Slozhnykh Sistem" USSR, Nauka Press, 1968 p 5–59
(JPRS-49211) Avail: CFSTI

The identification and characterization of complex systems are described, and the development of statistical models to simulate them is discussed. Examples given of complex systems are the telephone network and production processes, and the problem of automatic control is reviewed. The selection of an efficiency index and the quality control index is considered. Problems in studying complex systems are identified as those connected with studying the properties and behavior of the system and those of synthesis reducing to selection of the structure and values of the parameters. Details are given on the construction of mathematical models, the formalization of the system functions, and the utilization of the models, emphasizing the random processes inherent in the systems. N.E.N.

N70-12687# Krupp (Fried), G.m.b.H., Essen (West Germany). Rechenzentrum.
ON THE USE OF A NUMERICALLY CONTROLLED DRAFTING TABLE IN THE COMPUTER CENTER [UEBER DEN EINSATZ EINES NUMERISCH GESTEUERTEN ZEICHENTISCHES IM RECHENZENTRUM]
H. Hoppe and R. Stiefken *In its* Krupp Tech. Inform. Eng. Rept., Vol. 27, No. 1 Feb. 1969 p 47–53 In GERMAN; ENGLISH summary (See N70-12682 02-34)
Avail: CFSTI

The programming and use of a commercially available drafting machine controlled by a computer are described. Author (ESRO)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N70-11411*# General Electric Co., Auburn, N.Y. Semiconductor Products Dept.
THE DEVELOPMENT AND FABRICATION OF A POWER SCHOTTKY DIODE Final Report, 28 Jun. 1968–15 Aug. 1969
H. Heymann and J. Petruzella 15 Aug. 1969 118 p refs
(Contract NAS12-1230)
(NASA-CR-86266) Avail: CFSTI CSCL 09A

This report summarizes the work conducted to obtain a high current Schottky diode. After consideration and evaluation of various approaches to obtain such a device, the etched-down p-ring design was selected for fabrication of the final prototype devices. The selection of this design was based largely on its superior reverse blocking characteristics and process feasibility. The entire development program including device theory, design, fabrication, and characterization are discussed in detail. Finally, specific conclusions and recommendations based on the results of this study are presented. Author

N70-11425# Army Electronics Command, Fort Monmouth, N.J.
CAPACITOR FAILURES: RADIO SET AN/VRC-12
William L. Dudley and Melvin E. Cannon Jul. 1969 20 p refs
(AD-693251; ECOM-3153) Avail: CFSTI CSCL 17/2.1

Failures of capacitors in Radio Set AN/VRC-12 power supplies during service test are discussed. A failure mode analysis identifies the cause of failure and corrective action is presented. The proposed solution replaces the faulty transient suppressor capacitor with zener diode voltage clamps in the 400 Hz inverter circuit. Removal of the capacitor necessitates modification of the power transformer design to compensate for a change in circuit switching frequency. The proposed solution removes the source of trouble and improves system performance and reliability. Author (TAB)

N70-11428# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
A THEORETICAL STUDY OF A DIELECTRIC-FILLED TUBULAR MONOPOLE DRIVEN BY A COAXIAL LINE
C. Y. Ting and R. W. P. King May 1969 27 p refs
(Contract N00014-67-A-0298-0006; N00014-67-A-0298-0005; N00014-67-A-0298-0008)
(AD-693533; TR-589) Avail: CFSTI CSCL 9/5

The integral equation for the current in a dielectric-filled tubular monopole when driven by a coaxial line with an assumed pure TEM mode is formulated and solved by a numerical method. It is found that when the dielectric-filled tube can support a TM 01 circular waveguide mode, the characteristics of the antenna are drastically different. In this case a very sharp resonance behavior is observed. The resonant length depends primarily on the properties of the internal waveguide mode rather than on the free space behavior of the antenna. Author (TAB)

N70-11438# Naval Postgraduate School, Monterey, Calif.
A PROCEDURE FOR TESTING FOR REALIZABILITY AND

THE REALIZATION OF A CIRCUIT MATRIX
James Franklin Nale (M.S. Thesis) Apr. 1969 41 p refs
(AD-693048) Avail: CFSTI CSCL 9/5

Several procedures for the realization of a given realizable circuit matrix are reviewed and the techniques discussed. A new method for the realization of a given circuit matrix is introduced. The procedure also introduce a positive test to determine if the given matrix is realizable as a circuit matrix. Author (TAB)

N70-11479# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
LES-6 ANTENNA SYSTEM
Robert N. Assaly, Mark E. Devane, Bernard F. La Page, Milton L. Rosenthal, and Arthur Sotiropoulos 10 Mar. 1969 88 p refs
(Contract AF-19(628)-5167)
(AD-693197; TR-465; ESD-TR-69-43) Avail: CFSTI CSCL 9/5

The antenna system for a sixth experimental satellite (LES-6) is described. It is the first circularly polarized, deepun, VHF antenna to be successfully used on an orbiting satellite. A relatively high-gain (11-db peak) beam is electronically scanned to be always Earth-directed. The evolution from the simple LES-5 antenna system is detailed, and performance characteristics of the flight configuration are given. Author (TAB)

N70-11489# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
BATTLE SIMULATOR VIDEO TARGET MODULE
Ernest T. Messersmith, Jr. Aug. 1969 95 p
(Contract-NOw-62-0604-C)
(AD-693473; TG-1075) Avail: CFSTI CSCL 9/5

One approach to the problem of Naval weapon system evaluation and training is the hardware simulation of radar return signals, including targets, noise, ECM, and background. When target returns are simulated, the exact position of each target at any time is known and can be used as a reference to compare with the position generated by the equipment or personnel. The Target Module section of the Target Generation System for the APL Battle Simulator is described in detail, and information is provided for the operation, maintenance, and fabrication of this section of the equipment. The Target Module accepts digital data words from a data input source and simulated radar system and generates target video signals and associated attenuation signals. The output represents the target video in range, bearing, and elevation. Included in the report are descriptions of all electrical circuits used in its fabrication along with their associated drawings. Author (TAB)

N70-11499# Alabama Univ. Research Inst., Huntsville.
A STUDY OF WIDEBAND N-WAY POWER DIVIDERS Final Technical Report
H. Y. Yee, F.C.Chang, and N. F. Auden Jul. 1969 114 p refs
(Contract DAAH01-68-C-2147)
(AD-693290; UARI-RR-69) Avail: CFSTI CSCL 9/5

An N-way power divider which may serve as an array feeding system, splits the input signal into N equiamplitude and equiphase output signals as required. The study first emphasizes the transmission-line-type devices. A symmetric N-way junction followed by cascaded transmission-line segments and the associated interconnecting resistors (referred to as isolation resistances) compose a wideband power divider. The usual design requirements for the input voltage-standing-wave-ratio and isolations between output ports in a given frequency band may be achieved by a finite number of cascaded sections. Determination of the characteristic impedances of the transmission line segments and the resistances of the associated isolation resistors are formulated for a given number of sections and frequency bands. Values of these quantities are tabulated for number of sections from two to four and bandwidth from f sub 2:f sub 1 = 1.5 to 10.0. The second phase of this investigation is a waveguide power divider which is capable of high power operation. A qualitative discussion shows that multifurcating an expanded E-plane waveguide may be possible for dual band operations. Experimental results are presented for a simple design of this device. Author (TAB)

N70-11508*# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
FUNCTION GENERATOR PROTOTYPE CIRCUITS Final Report
George Borst 3 Mar. 1969 29 p
(Contract NAS8-30032)
(NASA-CR-102321) Avail: CFSTI CSCL 09E

Multichip hybrid techniques were used to fabricate mechanically rugged and electrically stable prototype function generator circuits. Circuit performance was diminished by an aging variation in the output function caused by the ceramic capacitors used in the timing circuits. This variation is predictable and decreases in time to a negligible amount, but necessitates the aging of the circuits at least 1000 hours after their last exposure to temperatures greater than 115 deg C to meet the stability requirements. Reduction of capacity aging effects is recommended by increasing the resistor values, decreasing the capacity values in the RC timing networks, and using a more stable capacitor. Temperature effects on ceramic capacitors are discussed, and performance and acceptance data sheets are given. M.H.E.

N70-11518# Naval Air Development Center, Johnsville, Pa.
COMPATIBILITY STUDY OF MS90298 CONNECTOR AND MS25384 FUEL NOZZLE TO AIRCRAFT JUMPER ASSEMBLY Final Report
P. F. Ardizzi 24 Jul. 1969 11 p refs
(AD-693444; NADC-AE-6908) Avail: CFSTI CSCL 9/1

Units procured as MS90298 and MS25384 items were evaluated and found undesirable for aircraft usage. New parameters and design features were developed to achieve satisfactory performance of the units. Recommendations were made to assure compliance of future units with the new requirements. Author (TAB)

N70-11544*# Philco-Ford Corp., Blue Bell, Pa. Microelectronics Div.
DEVELOPMENT OF QUALIFICATION TEST PROGRAM FOR MICROELECTRONIC DEVICES Final Report, 1 Nov. 1968 – 3 Jul. 1969
Walter D. Binelli and Richard H. Soltau Sep. 1969 82 p
(Contract NAS1-8714)
(NASA-CR-66848) Avail: CFSTI CSCL 09A

During qualification testing of digital monolithic integrated circuits step stress to failure tests showed that the bulk of failures occurred at stress levels well in excess of those in general usage. Product improvements resulted from repeated internal testing at levels above maximum ratings. Test devices selected consisted of the following family groupings: (1) diode – transistor logic; (2) resistor – transistor logic; and (3) transistor – transistor logic. G.G.

N70-11561# Sperry Rand Corp., Clearwater, Fla. Microwave Electronics Div.
SOLID STATE TUNABLE OSCILLATOR-MIXER AT X BAND Final Report, 1 Jun. 1968 – 15 May 1969
William M. Jones 15 May 1969 49 p
(Contract N00014-68-C-0451)
(AD-693547; SJ-224-5500-4) Avail: CFSTI CSCL 9/5

A Mixer/ATTO combination was assembled and tested. The components include a balanced mixer with a 400 MHz output, a solid-state avalanche diode oscillator tuned by a magnetically modulated YIG toroid, a directional coupler, and an isolator. Individual component design and performance are described and then the overall performance is given. Author (TAB)

N70-11568# Lincoln Lab., Mass. Inst. of Tech., Lexington. Ohio State Univ., Columbus. Dept. of Electrical Engineering.
THEORY OF THE CYLINDRICAL DIPOLE ON A SPHERE Final Summary Report

L. L. Tsai and D. V. Otto 17 May 1969 22 p refs Prepared by Ohio Sate Univ.
(Contract AF 19(628)-5167)
(AD-693190; FSR-2648-2; ESD-TR-69-202) Avail: CFSTI CSCL 9/5

A logical and straightforward approach to the problem of the cylindrical dipole mounted symmetrically on a conducting metallic sphere is given. The method used replaces the conducting sphere by a system of properly chosen interior sources whose coefficients are determined by Fourier Transform theory, an aperture condition, and variationally optimized point-matching. The results show agreement with experiment within about 5 percent. Extension of the method to other shapes is considered briefly. Author (TAB)

N70-11577# Army Foreign Science and Technology Center, Washington, D.C.
ANTENNAS WITH ELECTRICAL SCANNING
A. I. Ardabevskii et al. 15 Aug. 1969 23 p refs Transl. into ENGLISH from the Russian
(AD-693065; FSTC-HT-23-310-69) Avail: CFSTI CSCL 9/5

The article outlines the principle of electrical scanning methods for reflector and plane array antennas, including the use of frequency-change scanning and phase shifters. The advantages and disadvantages of parallel, series parallel and combined methods of connecting phase shifters in a linear system are discussed. A final section outlines problems in electrical scanning and suggests lines of future investigation in such areas as the change in antenna radiation pattern during scanning, possible reductions in the number of radiators required, and in miniaturization problems. Author (TAB)

N70-11581# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ATUOMATING THE INPUT OF SCRIPT INTO COMPUTERS
L. Telksnis 6 Jan. 1969 8 p Transl. into ENGLISH from Tr. Inzh.-Ekon. (USSR), no. 23, 1966 p 155-161
(AD-693537; FTD-HT-23-1165-68) Avail: CFSTI CSCL 9/2

An automatic reader for typewriter numerals is described. It reads typewritten 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and four other symbols. The readout date is yielded in the form of electric signals in a 7-digit binary code. The code can be punched. The reader output data can be marked on punchcards either in a decimal code or in the code of general-purpose digital computers. The highest reading speed is 150 symbols/sec. The reading veracity is less than one error in 10,000 signs. The automatic reader permits accelerating data introduction into computer by 75 times as compared to manual data introduction. Sample forms which can be read automatically are shown. Author (TAB)

N70-11588# Army Foreign Science and Technology Center, Washington, D.C.
GU-39A OSCILLATOR TUBES FOR WIDELY-EMPLOYED DEVICES
20 Jun. 1969 13 p refs Transl. into ENGLISH from the Russian
(AD-692651; FSTC-HT-23-633-68) Avail: CFSTI CSCL 9/5

The document establishes official standards for the manufacture, testing, storage and use of type GU-39A power tetrode oscillator tubes. Tube electrical parameters are furnished for testing and operating; water and air cooling requirements are also defined. Author (TAB)

N70-11600*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
A MINIATURE ELECTROMECHANICAL TUNNEL DIODE TRANSDUCER
W. Rindner, A. Garfein, E. Pittelli, and A. Iannini Washington Nov. 1969 30 p refs
(NASA-TN-D-5451; C-87) Avail: CFSTI CSCL 09A

The theory, fabrication, and performance of new gallium antimonide tunnel diode transducers are described. The outstanding features of these devices are simplicity, very small size (< 1 mm), good resolution (approximately 0.3 mm Hg for a 1000 Hz bandwidth) and wide dynamic range (approximately 60 dB). The temperature sensitivity is generally but not inherently, high (equivalent to approximately 25 mm Hg/deg C) but is readily reduced by conventional compensation techniques to the equivalent of about 1 mm Hg/ deg C or better. The present design is particularly attractive for biomedical applications for which special configurations and circuitry have been developed. In addition, an experimental tunnel diode accelerometer of miniature size and mass is described. Taking advantage of the tunnel diode switching characteristic, experimental circuitry has been designed to yield pulse-width pulse-width and frequency-modulated output with high percentage (approximately 0.5 percent/mm Hg) deviation. Author

N70-11623# Army Foreign Science and Technology Center, Washington, D.C.
ELECTRICAL ENERGY. ELECTRICAL ENERGY QUALITY STANDARDS AT POINTS OF CONSUMPTION CONNECTED TO THE GENERAL PURPOSE ELECTRICAL SUPPLY SYSTEM
19 Jun. 1969 17 p Transl. into ENGLISH from the Russian
(AD-692649; FSTC-HT-23-631-68) Avail: CFSTI CSCL 20/3

The document establishes standards for quality control indicators for electrical energy delivered to devices which utilize this energy under normal and post-emergency conditions, and applies mainly to general-purpose alternating current and direct-current electrical distribution systems. The quality indicators include frequency and voltage variation and fluctuation factors as well as waveform standards. Electrical supply parameter limits are established depending on conditions and type of load. Author (TAB)

N70-11684# Army Foreign Science and Technology Center, Washington, D.C.
A LONGITUDINAL-TRANSVERSE CRUCIFORM APERTURE IN THE WALL OF A SQUARE WAVEGUIDE
Yu V. Shubarin et al. 21 Aug. 1969 17 p refs Transl. into ENGLISH from Radiotekhn. (Moscow), v. 21, no. 3, 1966 p 77-83
(AD-693430; FSTC-HT-23-312-69) Avail: CFSTI CSCL 9/1

The polarization diagram of a cruciform aperture emitter in the wall of a square wave guide is examined, as a function of the deflection of the planes of polarization in the supply device and of the frequency and dimensions of the emitter. Theoretical and experimental work reveals that it is possible to control field polarization emitted by a cruciform aperture by controlling the polarization ffield of the basic waves which excite the square wave guide. Author (TAB)

N70-11692# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A DIGITAL COMPUTER ANALYSIS AND SYNTHESIS OF INSULATED GATE FIELD EFFECT TRANSISTOR COMPLEMENTARY CIRCUITS
Larry J. Harrell (M.S. Thesis) Mar. 1969 65 p refs
(AD-693011; GE/EE/69-8) Avail: CFSTI CSCL 9/5

A digital model of the insulated gate field effect transistor was proposed and used in the solution of two and three-element circuits. A number of circuits with desired characteristics were obtained by the method of variation of parameters in the model. Author (TAB)

N70-11702# Federal Fire Council, Washington, D.C.
FIRE PROTECTION FOR ESSENTIAL ELECTRONIC EQUIPMENT Recommended Practices No. 1
11 Jul. 1969 40 p refs Revised
(AD-692662; RP-1-Rev) Avail: CFSTI CSCL 13/12

The objectives of the Federal Fire Council are to reduce Federal life and property losses from fire through a cooperative effort of all Federal agencies coordinated through the Council; to promote and assist in the establishment of adequate fire safety

programs and criteria in all Federal agencies; to encourage fire research for the purpose of better understanding the phenomena of fire; and to develop better techniques for fire control, suppression, and prevention. The report presents the review and update of Recommended Practices for Fire Protection for Essential Electronic Equipment. Author (TAB)

N70-11706# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FIVE STABLE STATE TRIGGER AND ITS APPLICATION IN DECADE COUNTER
Shih-Chung Yang 16 Jun. 1969 10 p refs Transl. into ENGLISH from Tien Tzu Chi Shu (Chinese), no. 10, 1966 p 40-41
(AD-693401; FTD-HT-23-1180-67) Avail: CFSTI CSCL 9/5

Many digital computers are composed of four dual stationary triggers plus a feedback circuit. In this manner the computing circuit is rather complicated and reading the circuit is a complicated process also. This paper suggests a design of a digital computer from which this complication is eliminated. The operating theory and the direct current design of this computer are given in the paper. Author (TAB)

N70-11736# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANTENNA AND FEEDER DESIGN, VOLUME 1 [PROEKTIROVANIE ANTENNO-FIDERNYKH USTROISTV]
M. S. Zhuk et al 10 Jun. 1969 268 p refs Transl. into ENGLISH from the Russian
(AD-693008; FTD-HT-23-926-68-Vol-1) Avail: CFSTI CSCL 9/5

General methods of parameter calculation for antenna-feeder systems are briefly explained and the design of common types of antennas E.G. dipole slot, array, axisymmetrical, horn, and reflecting antennas are discussed. The methods of antenna directional pattern position control in antenna arrays are also described. TAB

N70-11737# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANTENNA AND FEEDER DESIGN, VOLUME 2 [PROEKTIROVANIE ANTENNO-FIDERNYKH USTROISTV]
M. S. Zhuk et al 10 Jun. 1969 254 p refs Transl. into ENGLISH from the Russian
(AD-693009; FTD-HT-23-926-68-Vol-2) Avail: CFSTI CSCL 9/5

Contents Antennas with corner reflector Radiator arrays with steerable radiation pattern Endfire antennas Waveguide radiators and horn antennas Reflector antennas. TAB

N70-11778# Tokyo Univ. (Japan). Dept. of Physics.
FIELD CALCULATIONS AND DISPERSION CURVES FOR PERIODICALLY LOADED STRUCTURES
R. L. Gluckstern Jul. 1969 23 p refs Sponsored by NSF
(SJC-A-69-5) Avail: Issuing Activity

The complete analytic solution for special models of periodic structures is formulated, and the relevance of these solutions to structure compensation is discussed. A waveguide is considered in which only one mode propagates, and in which the periodic perturbations are sufficiently far apart to neglect the interaction between them in all but the accelerating mode. Other waveguides with rectangular and arbitrary cross sections and with different aperture configurations are also investigated. General equations are derived to illustrate the dispersion curve appropriate to structure compensation for each type of waveguide. R.B.

N70-11805# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF THE RELIABILITY OF LOGIC UNITS DESIGNED WITH CONTACTLESS STANDARD ELEMENTS
O. A. Sedykh 20 Jun. 1969 12 p Transl. into ENGLISH from Pribory i Sistemy Upr. (Russian), no. 1, 1968 p 1-6
(AD-693395; FTD-HT-23-200-69) Avail: CFSTI CSCL 9/5

Contactless magnetic-and-semiconductior ELM-50, ELM-400, and ET elements have been extensively used in Soviet industrial automatic systems. The article presents a method of calculation of the malfunction probability of these elements and also of a 3-phase automatic circuit recloser designed with these elements. TAB

N70-11842# Stanford Linear Accelerator Center, Calif.
TRANSIENTS IN JUNCTION DIODE CIRCUITS
Arpad Barna Mar. 1969 32 p refs
(Contract AT(04-3)-515)
(SLAC-101) Avail: CFSTI

Switching properties of junction diodes are analyzed with emphas is on the effects of conductivity modulation resulting in inductive behavior. Transients are computed including conductivity modulation, diffusion capacitance, transition capacitance, and finite generator impedance. Author (NSA)

N70-11869# Sandia Corp., Albuquerque, N.Mex.
ANALYSIS OF IONIZING RADIATION EFFECTS IN FOUR-LAYER SEMICONDUCTOR DEVICES
C. W. Gwyn [1969] 29 p refs Presented at Conf. on Nucl. and Space Radiation, University Park, Pa. Sponsored by AEC
(SC-DC-69-1673; CONF-690704-3) Avail: CFSTI

The switching of a four layer semiconductor device in an ionizing radiation environment is calculated by solving the charge transport equations to determine the motion of the electron and hole distributions and the changes in the electric field distribution throughout a one dimensional device as a function of time. A discussion of the characteristic device turn-on as a function of the radiation exposure and external circuit and device parameters is presented. In addition to showing the detailed calculated device behavior, the theoretical and experimental results are compared. Author (NSA)

N70-11919# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A DEVICE FOR MODULATING AUDIO FREQUENCY SIGNALS
J. Felix 9 Jun. 1969 8 p Transl. into ENGLISH of Russian Patent no. 118722 (Appl. no. PV-1657-63, 23 Mar. 1963) 5 p
(AD-693610; FTD-HT-23-1) Avail: CFSTI CSCL 9/5

A device is described for modulating audio frequency signals. It consists primarily of transistorized amplifiers assembled in construction units, with a multi-throw switch placed at the input of the entire amplification sequence, an input preamplifier, two multipole switches placed between the output terminals of the preamplifier and the input terminals of the following correction amplifier or the input terminals of the regulator of the signal level, and an equalizing amplifier. There are collector buttons placed between the output terminals of the equalizing amplifier by collection terminals, a multi-throw switch attached by collection contacts to the input terminals of the output amplifier, the collection contacts of which are connected with the input terminals of the input preamplifier, and which are connected by special contacts of the collector buttons with the terminals of the output collector. By putting the corresponding button into a working position there will be an interruption of the connection between output switch and the corresponding collection terminal. The two points of the subject of the patent follow. TAB

N70-11934# National Bureau of Standards, Boulder, Colo. Radio Standards Physics Div.
TRANSISTORIZED LOW VOLTAGE REGULATOR CIRCUITS AND DESIGN
John H. Rogers Sep. 1968 39 p refs
(NBS-TN-371) Avail: SOD $0.30

Simplified design equations and circuits are presented for three separate transistor voltage regulator circuits covering the range of 2 to 30 volts. Examples of design, use of equations,

selection of components and performance data are presented. An appendix is included to show the use of recent integrated circuit voltage regulators. Author

N70-11936*# Radio Corp. of America, Lancaster, Pa. Industrial Tube Div.
DEVELOPMENT OF A STERILIZABLE RUGGEDIZED VIDICON FOR LUNAR AND PLANETARY PHOTOGRAPHY Final Report, 21 May 1965 – 21 Nov. 1967
S. A. Ochs Dec. 1967 110 p Prepared for JPL
(Contracts NAS7-100; JPL-950985)
(NASA-CR-106998) Avail: CFSTI CSCL 09A

A one-inch vidicon was developed which can withstand ethylene oxide and dry heat sterilization as well as exposure to severe shock and vibration. The tube has ceramic – metal modular construction and is potted in a magnetic shield. Electrostatic focusing and magnetic deflection are employed. Electrical performance is encouraging with resolution of over 500 TV lines having been observed. Author

N70-11994# Naval Oceanographic Office, Washington, D.C.
LONG DISTANCE TRANSMITTER REMOTE ACTION [IMPULSNYE USTROISTVA DALNEGO DEISTVIYA]
E. Ya. Shchegolev 1968 19 p Transl. into ENGLISH from the Russian
(AD-693591; NOO-Trans-415) Avail: CFSTI CSCL 9/5

The pulse-systems that can be successfully utilized in the determination of the ships position are outlined, giving information on the arrangement of ground stations, transmitters and ship-borne receivers. The recommended wave-lengths, frequencies, intervals and their significance in the accuracy of measurements are discussed, analyzing the nature and magnitude of errors caused by various phenomena. TAB

N70-12022# Sandia Corp., Albuquerque, N.Mex.
IMPURITY EFFECTS ON TRANSISTOR CURRENT GAIN AND RADIATION TOLERANCE AT LOW TEMPERATURES
H. H. Sander, C. W. Gwyn, and B. L. Gregory [1969] 21 p refs Presented at Conf. on Nucl. and Space Radiation, University Park, Pa. Sponsored by AEC
(SC-DC-69-1678; Conf-690704-4) Avail: CFSTI

The current gain of a typical bi-polar transistor drops rapidly with decreasing temperature below room temperature, falling to near zero at approximately 100 deg K. However, quite different behavior is observed in NPN silicon transistors where gallium is employed as the base dopant. In these devices the gain drops in the usual manner as the temperature is decreased from 300 deg K to approximately 135 deg K. Below 135 deg K the gain increases with decreasing temperature, reaching a peak at approximately 76 deg K. Qualitatively, this behavior of the transistor gain at low temperature can be expalined in terms of the change in emitter injection efficiency with temperature as a result of the different rates of carrier freeze-out in the base and emitter regions. Of even greater interest in the gallium doped devices is a significantly increased tolerance to neutron irradiation at the "gain peak" temperature versus that observed in these devices at room temperature. This behavior may be explained in terms of the decrease in the recombination in the emitter space charge region at low temperatures. Author INSA)

N70-12098# Central Research Inst. for Physics, Budapest (Hungary).
NEW EXPERIMENTS ON GIANT ZERO BIAS TUNNELING ANOMALY: EFFECT OF IMPURITY DISTRIBUTION
F. Mezei 1969 10 p refs
(KFKI-1/1969) Avail: AEC Depository Libraries

The dynamical resistance R(V) = dV/dI versus V of Al/Al2O3/al tunnel junctions was measured by the standard modulation technique. The fabrication of the junctions is described. The giant zero bias anomaly was found here under entirely different preparation conditions than in previous work. NSA

N70-12122# Los Alamos Scientific Lab., N.Mex.
PRECISION STAIRCASE CALIBRATOR FOR FIELD USE
R. R. Fullwood 1 May 1969 8 p
(Contract W-7405-eng-36)
(LA-4178-MS) Avail: CFSTI

A linear nine-step staircase calibrator has been constructed for field use capable of +90 V to a 51 ohms load on the top step. The step voltages are obtained by measuring the continuously variable supply voltage and using tables provided in this report. Author (NSA)

N70-12125# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.
HIGH VOLTAGE MONITOR SYSTEM MANUAL
T. Thompson 11 Oct. 1968 22 p
(Contract AT(29-1)-1183)
(EGG-1183-1408) Avail: CFSTI

Each critical (i.e., program triggering and critical coverage) detector high voltage power supply in a typical diagnostic system is monitored to ensure that the voltage does not drift out of set limits. This monitor may be used to monitor any voltage within its range but was designed for and is used primarily with detector power supplies. The range of allowable voltage drift is set by positioning limit switches on a control meter relay in the voltage monitor which is connected to the high voltage power supply output. The high voltage monitors described are designed to provide an expanded scale, suppressed zero, meter indication in two ranges: 0 to 10 kV and 5 to 20 kV. In expanded scale, the 10-kV unit has a full scale deflection on the meter face of 200 V; the 20-kV unit has a full scale sensitivity of 2 kV. Five monitor modules and a power supply module are packaged in a standard nuclear instrument bin. Circuit description, specifications, and operating instructions for the high voltage monitor system are presented. Author (NSA)

N70-12137*# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical Engineering.
STUDY OF SEMICONDUCTOR HETEROJUNCTIONS OF Zn Se, Ga As AND Ge Quarterly Report, 1 Aug. – 31 Oct. 1969
A. G. Milnes and D. L. Feucht 31 Oct. 1969 17 p
(Grant NGR-39-087-002)
(NASA-CR-107044) Avail: CFSTI CSCL 09A

The fabrication problems and device characteristics of Ge-GaAs and ZnSe-GaAs heterojunctions ar studied. The quality of the XnSe layer grown on GaAs, using close-spaced HCl process, was investigated as a function of the substrate orientation. The best layers have been obtained for GaAs substrates orientation. The best layers have been obtained for GaAs substrates oriented 5 deg off (111) and low HCl concentrations. Various techniques for diffusing Zn into the ZnSe layer to reduce its resistivity and through it to form the base region of an nZnSe-pGaAs-nGaAs transistor were studied. Process control is quite critical in this technology in order to obtain useful transistor performance. The low-temperature iodine system has been used to grow Ge on GaAs. Preliminary measurements on the resulting diodes showed considerable improvement in their forward i-v characteristics and no trace of cross-diffusion. The solar-cell efficiency of ZnSe-GaAs, GaP/Si, ZnSe-Ge and GaAs-Ge heterojunctions have been computed and compared with Si and GaAs homojunction cells. The performance potential of ZnSe-GaAs cells is shown to exceed that for both Si and GaAs cells if interface recombination losses are small. Author

N70-12143# Naval Research Lab., Washington, D.C. Space Applications Branch.
THE DESIGN OF AN INEXPENSIVE MULTICHANNEL PROGRAMMED RECORDER
A. W. Baldwin and C. E. Carson *In its* Rept. of NRL Progress, Oct. 1969 p 32 – 35 (See N70-12140 02-34)
Avail: CFSTI

The design of a low cost portable recorder for the navigation satellite system Timation is described and circuit diagrams are

included. The system features an analog readout of five signals programmed over a 6-sec period, a multichannel oscilloscope display, a permanent trace record on Polaroid film, and a provision for triggering the system. The system is reported to perform within a 2% record accuracy, to be much lighter than a two-pen conventional recorder, and to cost under $500. N.E.N.

N70-12154# Pennsylvania Univ., Philadelphia. Office of Engineering Research.
VALIDATION OF THEORETICAL AUTOMATIC CHECKOUT TECHNIQUES Final Report, Jun. 1965 - Aug. 1968
Raymond S. Berkowitz, William G. Faust, and Michael M. Vartanian Oct. 1968 308 p refs
(Contract AF 33(615)-2609)
(AD-692774; AFAPL-TR-68-120) Avail: CFSTI CSCL 14/2

Experimental and theoretical studies were made for the validation of theoretical automatic checkout techniques. After a discussion of the state of art, detailed validation studies are described for three specific fault isolation techniques: the UNIVAC Key Element Search, the RCA-Test Point Algorithm Technique, and the University of Pennsylvania Statistical Estimation Fault Isolation Procedure. The extent to which such techniques can be applied to practical electronic circuits is determined; it is indicated that the procedure embodying estimation of component parameter values has most potential value as a general purpose fault isolation technique. Thorough discussions are presented of the experimental equipment designed and assembled, the FORTRAN programs written for the IBM-7094, and the PLACE programs written for the Bendix AN/GJQ-9 as required in the detailed validation studies. Additional contributions are presented concerning fault isolation of control systems as well as a variety of electronic systems with suggestions as to future Air Force efforts in the automatic checkout field. Author (TAB)

N70-12177# Wisconsin Univ., Madison. Dept. of Physics.
A SIMPLE TL DETECTOR USING A PHOTORESISTOR
E. Podgorsak, D. W. Pearson, and J. R. Cameron 15 Jul. 1969 5 p
(Contract AT(11-1)-1105)
(COO-1105-153) Avail: CFSTI

A brief description of an inexpensive reader for thermoluminescent dosimeters is given. The system consists of a cadmium sulfide photoresistor as the light sensing element and an operational amplifier for amplification of the signal. NSA

N70-12201# Toulouse (France). Faculté des Sciences.
RADIATION EFFECT ON MOS TRANSISTORS [ACTION DES RAYONNEMENTS SUR LES TRANSISTORS MOS]
Jean-Claude Reuanet (Ph.D. Thesis) 25 Jun. 1969 81 p refs In FRENCH
Avail: CFSTI

The structure and characteristics of MOS transistors are recalled. Special attention is devoted to threshold voltage and to the mobility of charge carriers for which an analytical equation is computed. Effects of electrons with an energy of 4.5 MeV, of protons with an energy of 600 MeV, of neutrons with an energy of 14 MeV and of γ rays emitted by cobalt 60 are analyzed and the degradation of the carrier mobility is tabulated. Author (ESRO)

N70-12210*# Case Western Reserve Univ., Cleveland, Ohio. Solid State Electronics Lab.
SOLID STATE ELECTRONICS LABORATORY Semiannual Report, Feb. - Sep. 1969
W. H. Ko, E. T. Yon, D. Ramseth, and S. Mabrouk Sep. 1969 9 p
(Grant NGR-36-003-079)
(NASA-CR-107030; SAR-8) Avail: CFSTI CSCL 09A

The major purpose of this project is to design and fabricate miniaturized, portable external heart rate and ECG monitoring systems for prolonged space missions. The heart rate system has been designed and is being evaluated in breadboard form. All electrical specifications for the system have been met or exceeded in the breadboard model. The amplifier, oscillator, and power amplifier of the rate monitoring system are common to the ECG system, therefore, the only major subsystem remaining to be designed and constructed for the ECG monitoring system is the subcarrier oscillator-modulator. Author

N70-12241# Royal Aircraft Establishment, Farnborough (England).
REPORT ON THE ASSESSMENT OF LANGUAGE LABORATORIES
P. R. Still, M. A. Jenkinson, and A. R. Peacock May 1969 117 p
(RAE-TR-69100) Avail: CFSTI

The Ministry of Technology (Royal Aircraft Establishment) carried out a survey of language laboratories currently marketed in this country on behalf of the Department of Education and Science. Information is given on how the survey was conducted and the findings of the survey. The facilities available with each laboratory are noted and an assessment of the technical standard of the main parameters listed. Laboratories are compared with a Mintech specification a copy of which is included in this report. Author (ESRO)

N70-12261*# TRW Systems, Redondo Beach, Calif.
MICROMINIATURE SIGNAL CONDITIONING SYSTEM, VOLUME 1 Final Report
Oct. 1969 239 p
(Contract NAS9-7429)
(NASA-CR-102013; TRW-R09432-6001-R00-00-Vol-1) Avail: CFSTI CSCL 09A

The work performed to complete the monolithic module design of a low level signal conditioning system, and extend the capability of a breadboard system to 90 channels is described. The advantages of this system over discrete component systems are considered to be significant reductions in power requirements, weight, and volume, which are made possible by the development of the monolithic signal conditioning amplifier in conjunction with the power gating techniques. The system design, module design, integrated circuit technology, and testing procedures are included. F.O.S.

N70-12262*# TRW Systems, Redondo Beach, Calif.
MICROMINIATURE SIGNAL CONDITIONING SYSTEM, VOLUME 2 Final Report
Oct. 1969 200 p
(Contract NAS9-7429)
(NASA-CR-102014; TRW-R09432-6001-R00-00-Vol-2) Avail: CFSTI CSCL 09A

For abstract see N70-12261.

N70-12279*# Westinghouse Research Labs., Pittsburgh, Pa. Information Devices Dept.
DESIGN AND FABRICATION OF AN ANALOG VOLTAGE TO DUTY CYCLE GENERATOR Final Report
Feb. 1969 153 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951306)
(NASA-CR-106970) Avail: CFSTI CSCL 09A

This report covers work on a voltage to duty-cycle converter fabricated on four silicon integrated circuit chips assembled in a single package. It will perform the essential signal processing functions of a precision power regulator system using duty-cycle control of the power output stages. The converter subsystem requires large value stable capacitors and high precision stable resistances which are obtained by using a hybrid tantalum film-planar silicon integrated circuit technology. In this technology, the capacitors have tantalum oxide (Ta_2O_5) for the dielectric and the precision resistors are made of tantalum nitride (TaN). The four circuits in the subsystem are a precision voltage reference supply, a gain-stable error voltage amplifier, a stable triangle waveform generator, and a comparator with output logic. Stability and linearity are achieved

in an operating temperature range of -10 deg C to +75 deg C, not only through the use of the stable tantalum film components in sensitive areas, but also by the use of resistance ratios to determine well-defined voltage levels. Also, adjoining transistor pairs for input stages of difference or comparison amplifiers are used where minimum drift is needed. Author

N70-12305# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).

DAMPING IN ROLL OF A SOUNDING BALLOON GONDOLA [STABILISATION EN ROULIS D'UNE NACELLE DE BALLON SONDE]

Ic. Raymond 19 Jun 1969 112 p In FRENCH

(LRBA-E-28-NT-5/SAe) Avail: CFSTI

The electronic equipment used for roll stabilizing a balloon instrument package intended for obtaining high resolution photographs is described. ESRO

N70-12317# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.

AN ESTIMATE OF THE EFFECT OF FORCED CONVECTION ON ANTENNA BREAKDOWN AND SLOTTED ANTENNAS

Eugene E. Covert May 1969 34 p refs

(Contract F19628-69-C-0043)

(AD-692761; SR-2; TR-154; AFCRL-69-0264; AFCRL-69-0264) Avail: CFSTI CSCL 9/5

The equation for conservation of electron number density is used to calculate the number density growth rate for a gas flowing over a conducting ground plane past a slot antenna. When used with a breakdown condition, this growth rate implies a breakdown voltage. The second term of a series solution shows the reduction of time that an electron is in the exciting electric field. Since the electrons are convected through the exciting electric field, the breakdown acts as if the electric field were pulsed, even when it is on continuously. As a consequence, the pulse time used to calculate the first term breakdown is either the pulse duration or the effective transit time, whichever is shorter. Another effect of forced convection is to increase the concentration of electrons near the wall, which improves the coupling between the electrons and the nonuniform electric field outside the slot antenna, thereby initially reducing the breakdown voltage. Author (TAB)

N70-12318# Massachusetts Inst. of Tech., Cambridge. Aerophysics Lab.

AN APPROXIMATE CALCULATION OF THE BREAKDOWN CONDITION FOR EXTERNAL SLOT ANTENNAS

Eugene E. Covert May 1969 39 p refs

(Contract F19628-68-C-0043)

(AD-692760; SR-1; TR-153; AFCRL-69-0263) Avail: CFSTI CSCL 9/5

A calculation of the conditions for the voltage breakdown in air outside a slot antenna, including the nonuniform electromotive force field, is presented. The approximation is developed by using the equation of conservation of electrons and experimental data describing the ionization rate. For pulsed and continuous waves the effects of the nonuniform electric field can be interpreted as a changed diffusion length. For pulsed breakdown the initial distribution of electrons is generally more important than the free diffusion of electrons. Each of these factors tends to increase the pulse breakdown voltage above the value estimated by the uniform field approximation. In view of the differences between uniform and nonuniform field breakdown characteristics, it is suggested that the experimental definition of antenna breakdown be reconsidered. Author (TAB)

N70-12326# Ohio State Univ., Columbus. Electroscience Lab.

AN EXPERIMENTAL INVESTIGATION OF MODIFIED DIPOLE ANTENNAS

Danai Lekhyananda (M.S. Thesis) 2 Jul. 1969 59 p refs

Prepared for Lincoln Lab., Mass. Inst. of Tech.

(Contract AF 19(628)-5167)

(AD-692783; OSURF-2648-1; ESD-RE-69-209) Avail: CFSTI CSCL 9/5

Dipole antennas with metallic shells for housing electronic equipment at the center which are called modified dipole antennas were investigated. Measurements were made on the input admittances and far field patterns of the modified dipole antennas with cylindrical and spherical shells. The input admittances of 120 degrees vee-antennas with spherical shells were also measured. The metallic shells were constructed in two diameters, 0.0625 wavelength and 0.03125 wavelength. The operating frequency used was 375 MHz. Admittance measurements were made using a Hewlett-Packard Model 803 A VHF Bridge. Input admittances were measured as a function of antenna wire length. Radiation patterns were measured in the E sub theta theta plane for various antenna wire lengths in the resonant region. Author (TAB)

N70-12481# European Space Research and Technology Center, Noordwijk (Netherlands).

SURFACE AND BULK EFFECTS DUE TO SPACE RADIATIONS IN ELECTRONIC COMPONENTS

R. A. Reid Jun. 1969 46 p refs Presented at the 6th ESRO Summer School, Noordwijk, Neth., 1968

(ESRO-TN-76) Avail: CFSTI

Radiation is damaging to all types of components, but in most cases the critical level is higher than that actually experienced in space. Components using organic materials and semiconductors are the most vulnerable to damage by radiation. Semiconductor devices are prone to degradation of the parameters necessary for successful operation, both in the bulk of the material and at the surface of the device, the latter being due to effects within and on the protective oxide layer. The complete shielding effect of the body of the spacecraft is difficult to compute; and in all cases the decision to fly a component should be based on its known sensitivity to radiation and the radiation environment of the orbit into which it is placed. Author (ESRO)

N70-12515*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Electrical Power Systems.

PASSIVE SOLAR ARRAY ORIENTATION SYSTEM (THERMAL HELIOTROPE) Quarterly Report, 23 Mar. - 23 Jun. 1969

Jun. 1969 59 p refs

(Contract NAS5-11637)

(NASA-CR-107120; QR-2) Avail: CFSTI CSCL 09A

An evaluation of the feasibility of thermally actuated sun-tracking systems is reported. These systems use bimetal elements for both sensing and motive power. The project explores the feasibility of providing solar array sun-tracking capability through the use of non electrical devices. It consists of five main tasks: (1) survey general tracking requirements such as rate and torque requirements, (2) study thermal heliotrope operating mechanisms and develop concepts, (3) analyze thermal properties and provide conceptual designs, (4) fabricate and test models in simulated orbit environments, and (5) document findings and recommendations. The general tracking requirements were surveyed and typical missions categorized. Two axis tracking was considered and impulse requirements investigated. Factors influencing tracker thermal response were studied and thermal coating trends chosen. Several concepts for bimetal sun trackers were developed and conceptual models fabricated. Preliminary tests were performed to "wring out" models prior to final testing. Fabrication of three models is complete. Progress to date shows feasibility of the thermal heliotrope sun tracker concept. Four tracking concepts were chosen for model fabrication and testing. Preliminary testing of three of these models has indicated functionability of the concepts. Author

N70-12590# Akademiya Nauk URSR, Kiev.

A METHOD FOR CONVERTING THE REVERSE CURRENT OF A TRANSISTOR TO DIGITAL FORMAT

A. G. Ryzhevskiy *In its* Methods for Collecting and Process. Inform. 1967 p 131-139 refs In RUSSIAN (See N70-12576

02-34)
Avail: CFSTI

The time required for the reverse current of a transistor to charge a calibrated capacitor to a fixed voltage, i.e. to accomplish a pulse-time conversion, is used as the measured parameter. This basic circuit is incorporated into a converter consisting of a stable-frequency pulse generator, coincidence circuit, pulse counter, and a circuit for converting the value of the controlled transistor reverse current to a proportional time interval. This circuit is made up of a binary flipflop, a threshold gate, and a power source. When a switch in the device is closed, the voltage from the power source is fed to the calibrated capacitor-controlled transistor circuit. The binary flip-flop is triggered by the wave front of the voltage drop, the pulses from the generator being transmitted to the pulse counter. While the capacitor is being charged by the reverse current to the response voltage of the threshold gate, a pulse is transmitted to the flip-flop which returns it to the initial state and which prevents transmission of pulses to the counter. At selected voltages of the threshold gate and selected capacitance of the calibrated capacitor, the number of pulses transmitted to the counter during charging of the capacitor is calculated digitally by the value of the reverse saturation current. Transl. by R.B.

N70-12591# Akademiya Nauk URSR, Kiev.
TRANSIENT RESPONSES IN A VACUUM-TUBE TWO-CAPACITOR FREQUENCY METER
Yu. N. Bobkov *In its* Methods for Collecting and Process. Inform. 1967 p 140–150 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

The transient responses in a triode-tube two-capacitor circuit for converting frequency to voltage are investigated to determine the conditions of completing charge-discharge processes, instantaneous values of output voltage, the ratio of peak output voltage to average values, and the instantaneous and average output resistances of the converter. Formulas are derived for calculating the circuit parameters under different operating conditions. Transl. by R.B.

N70-12593# Akademiya Nauk URSR, Kiev.
THE EFFECT OF NONLINEAR DISTORTIONS OF MODULATING FREQUENCY VOLTAGES ON THE ACCURACY OF A HELIUM MAGNETOMETER
L. N. Grabar, V. N. Mikhaylovskiy, and V. D. Sokolov *In its* Methods for Collecting and Process. Inform. 1967 p 156–161 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

A helium magnetometer, utilizing the Zeeman effect and optical pumping in metastable helium, has a number of advantages over cesium and rubidium magnetometers: 1) it does not require thermal stability of the absorption chamber; 2) it has a higher conversion constant of 28 Hz (as opposed to 4 to 6 Hz for the other magnetometers); 3) there are no spurious resonances; 4) and calculation of the root-mean-square member of BH-2 (horizontal component and intensity of the magnetic field) is not required. A modulating generator with low nonlinear distortion is recommended to overcome the high frequency resonance caused by the higher harmonics of the modulating magnetic field. In order to achieve the required measurement error of less than 0.5 gamma, the content of the second harmonic should not be greater than 1 per cent. Transl. by R.B.

N70-12613*# Hughes Aircraft Co., Los Angeles, Calif.
PHASE MULTIPLYING ELECTRONIC SCANNING SYSTEM Patent Application
Arthur F. Seaton, inventor (to NASA) Filed 11 Aug. 1969 28 p
Prepared in cooperation with JPL
(Contracts NAS7-100; JPL-950056)
(NASA-Case-NPO-10302; US-Patent-Appl-SN-848811) Avail: CFSTI CSCL 09A

The novelty of the invention lies in the use of variable susceptances in the signal paths of two branch arms of a T-junction for phase and amplitude control of a signal transmitted through a third branch as the difference in a signal divided between the two branch arms. The invention relates to electronic control of the phase and amplitude of a signal being transmitted out of, for example, a slot in an antenna array. Such control is desired in an antenna array for beam scanning. NASA

N70-12619*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DRIVE CIRCUIT FOR MINIMIZING POWER CONSUMPTION IN INDUCTIVE LOAD Patent Application
William E. Crawford, inventor (to NASA) Filed 19 Aug. 1969 16 p
(Contract NAS7-100)
(NASA-Case-NPO-10716; US Patent-Appl-SN-851394) Avail: CFSTI CSCL 09A

A circuit for driving an inductive load, such as a solenoid, so as to minimize the solenoid power consumption. The circuit parameters are selected so as to apply a driving voltage to the solenoid until the solenoid current exceeds the "pull-in" current. Then the circuit automatically terminates the driving voltage and the current through the solenoid is permitted to decay to a value just exceeding the "drop-out" current. The circuit then continues to cycle on and off to alternately drive current through the solenoid and permit it to decay while always maintaining the solenoid current in excess of the drop-out current but considerably below the pull-in current. This cycling continues until the solenoid activate switch is opened. NASA

N70-12620*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ULTRA-FLEXIBLE BIOMEDICAL ELECTRODES AND WIRES Patent Application
Salvadore A. Rositano, inventor (to NASA) Filed 9 Sep. 1969 19 p
(NASA-Case-ARC-10268-1; US-Patent-Appl-SN-856257) Avail: CFSTI CSCL 09A

Discussed is a flexible, stretchable biomedical electrode and connector which is designed for use by physicians, medical technicians and researchers to connect an electric instrument to the body. A soft, flexible electrode is provided by using an elastomer which has been loaded with a conductive powder with a connecting "wire" formed as part of the electrode of the same material. This conductive electrode for biopotential measurements or stimulation has a low contact potential and an electrical cable which will conform to the body contour during body motion. The "wire" itself is not only flexible but stretchable. NASA

N70-12623*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HERMETICALLY SEALED ELBOW ACTUATOR Patent Application
Hans F. Wuenscher, inventor (to NASA) Filed 25 Aug. 1969 15 p
(NASA-Case-MFS-14710; US-Patent-Appl-SN-852843) Avail: CFSTI CSCL 09A

Described is a hermetically sealed elbow actuator comprising first and second pairs of pivotally connected angular actuating elements arranged between a base member and a head member. The base member houses a motor that forces incremental deflection of the actuating elements and the head member through a system of drive rods and expandable linkages. Limited deflection of each pair of actuating elements permits all of the moving parts, including the motor, to be hermetically sealed by a metallic bellows since the deflection of each pair of actuating elements is small enough to be within the bending tolerance of the bellows. NASA

N70-12635# North American Rockwell Corp., Anaheim, Calif. Autonetics Div.
DIGITAL FREQUENCY SHIFTER FOR 10.6 MICRON RADIATION Final Report, Mar. 1968–Aug. 1969

Aug. 1969 117 p refs
(Contract N00014-68-C-D193; ARPA Order-306)
(AD-693189; 09-1641/501) Avail: CFSTI CSCL 20/6

A theoretical and experimental study of frequency shifters for 10.6 microns is presented. Three different designs were considered. Two of these designs made use of the electro-optic effect in GaAs to obtain a single side band frequency shift. The third design utilized the acousto-optic properties of germanium. Bragg reflection and 60 percent conversion efficiency were obtained in this acoustic frequency shifter with an input power of 4.4 watts at 10 MHz. A design is presented for a digital frequency shifter which can produce discrete frequency shifts from -1.2 GHz to +1.2 GHz in 200 MHz steps. Author (TAB)

N70-12867*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A BRUSHLESS DIRECT CURRENT TACHOMETER Patent Application
Frank J. Nola inventor (to NASA) Filed 28 Aug. 1969 14 p
(NASA-Case-MFS-20385; US-Patent-Appl-SN-853716) Avail: CFSTI CSCL 09A

A DC tachometer is disclosed utilizing Hall effect crystals to achieve brushless commutation. A crystal is placed at the center of a pole defined by each of the armature windings of an alternator having a permanent magnet rotor. The Hall effect crystals are positioned to be responsive along a first axis to the flux generated by the permanent magnet and have a second axis perpendicular to the first axis electrically connected to the armature windings so as to be responsive to the current induced in the armature winding upon rotation of the rotor. The output voltages of the Hall effect crystals appearing on the axis perpendicular to the first and second axes are summed to obtain a voltage proportional to the speed of the rotor that is independent of rotor position. NASA

N70-12870# Lockheed Missiles and Space Co., Palo Alto, Calif.
NEW INFRARED RADIATION RECEIVER BASED ON n-CdSb
V. K. Maliutenko et al 1969 2 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 14, no. 9, 1969 p 1567–1568
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Some parameters of photoresistors fabricated from tellurium-doped n-CdSb are reported. Besides the high exposure capacity, the developed receivers differ from existing ones by a lower total reference, which facilitates making them agree with the measurement ring, and a high multiplicity of a reference shift during exposure. An essential deficiency of n-CdSb receivers is their considerable inertia. However, the time constant can be diminished substantially by negligible heating of the sample, by external illumination, or by increased doping. Author

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N70-11608*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CASCADE IMPEDANCE SYNTHESIS USING AN EXTENSION OF THE FIALKOW-GERST THEOREM
John P. Barranger Washington Nov 1969 66 p refs
(NASA-TN-D-5564; E-4591) Avail: CFSTI

A new driving point impedance synthesis is found based on an extension of the Fialkow-Gerst theorem. The resultant network is a cascade of lossless network sections where each section corresponds to zeros of the even part of the driving point impedance. The network section corresponding to complex even part zeros consists of reactances, a transformer, and a gyrator. The proof of the validity of this network is based on a new technique of impedance operator even part identification. An advantage of the new realization is the reduction in the number of gyrators used compared with the Fialkow–Gerst cascaded network. Author

N70-11775*# Cutler-Hammer, Inc., Deer Park, N.Y.
STUDY OF QUASI-OPTICAL CIRCUIT TECHNIQUES IN VARACTOR MULTIPLIERS
Jesse J. Taub and Gediminas P. Kurpis Washington NASA Nov. 1969 122 p refs
(Contract NAS12-625)
(NASA-CR-1453) Avail: CFSTI CSCL 09C

Circuit techniques applicable to quasi-optical multipliers operating at millimeter wavelengths have been studied. Directional filters consisting of iterations of dielectric slabs have been theoretically and experimentally investigated. A theory that is in good agreement with experiment is presented together with a step-by-step design procedure. Three types of tuner circuits to be used as impedance matching devices have been theoretically analyzed for their range of matching and dissipation loss properties. The dissipation loss is low (less than 0.2 db) for all types. A tuner consisting of a variable susceptance with variable position is found to be the best of the types described. The problem of representing quasi-optical varactor mounts by suitable equivalent circuits is considered but its completion must await experimental work to be performed on a future program. The report concludes with a discussion of measurement techniques suitable for quasi-optical components. Author

N70-12321*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASUREMENTS OF DIELECTRIC CONSTANTS AND LOSS TANGENTS AT E-BAND USING A FABRY-PEROT INTERFEROMETER
Constantine A. Balanis Washington Dec. 1969 53 p refs
(NASA-TN-D-5583) Avail: CFSTI CSCL 09C

Dielectric constant and loss tangent measurements of polytetrafluoroethylene (teflon), polystyrene, and polymethyl methacrylate (lucite, plexiglas) were made at E-band (approximately 60 to 90 GHz) using a Fabry-Perot interferometer. These measurements provided experimental data not previously available at these frequencies. In addition, they provided further verification of the use of the Fabry-Perot interferometer as an effective instrument for measuring dielectric constants and loss tangents in the millimeter wavelength region. Samples of various thicknesses and surface finishes were used to determine the effect of these variables on the measurements. To determine the variation of dielectric constants with temperature, measurements were made over a limited temperature range and a reduction in value was observed at higher temperatures. Author

N70-12376*# Texas Univ., Austin. Electronic Materials Research Lab.
RESEARCH ON DIGITAL TRANSDUCER PRINCIPLES VOLUME 6: THE PHOTODIELECTRIC EFFECT IN CADMIUM SULFIDE, 1 JULY 1967–30 JUNE 1968
James J. Hinds and William H. Hartwig 30 Jun. 1968 132 p refs
(Grant NGR-44-012-043)
(NASA-CR-107018) Avail: CFSTI CSCL 10C

In cadmium sulfide single crystals at cryogenic temperatures, the photodielectric effect is a result of trapping of optically generated electrons. A change in both the real and imaginary parts of the dielectric constant is observed when the semiconductor sample is placed in a superconducting microwave resonant cavity and illuminated. The resonant frequency of the cavity decreases due to an increase in the real part of the dielectric constant, while a change in the imaginary part is detected as an increase in the amount of microwave power absorbed in the cavity. Using a simple harmonic oscillator to represent trapped electrons, equations are

derived which accurately predict the change in the dielectric constant due to those electrons. It is shown that the magnitude of the photodielectric effect due to a single trapped electron is proportional to E(−3), where E is the se paration of the tra p ping level from the conduction band. There is a minimum usable value of E, however, found to be about 0.001 eV. For smaller energies, the electron acts like a free electron. Other parameters which affect the size of the cavity frequency change are the density of trapped carriers, the sample volume and the resonant frequency of the cavity. Author

N70-12580# Akademiya Nauk URSR, Kiev.
ANALYSIS OF DIGITAL SYSTEMS CONTAINING SMOOTH FILTERS
V. S. Demeshov and Yu. M. Korshunov *In its* Methods for Collecting and Process. Inform. 1967 p 34–42 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

Errors in an automatic control system were analyzed. The system comprised a digital smoothing filter, and prediction and delay units. System output errors under various interference conditions were assessed and filter parameters were defined on the basis of minimum total error. Transl. by E.C.

N70-12596# Gorky A. A. Zhdanov Polytechnic Inst. (USSR).
FERRORESONANT CONTROL STABILIZERS FOR VOLTAGE AND CURRENT
A. M. Bamdas, S. V. Sha piro, and V. A. Gladilov *In* Akad. Nauk URSR Methods for Collecting and Process. Inform. 1967 p 175–179 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

The voltage stabilizer consists of a controlled choke coil with internal feedback and a capacitor which is switched on in series with the coil, while the load of the stabilizer is switched on in parallel with the coil. At any current for controlling the choke the volt-ampere characteristics are similar and are analogous to the characteristics of an ordinary coil with a saturated core. The current stabilizer is made up of a resonant controlled choke coil and capacitor, coupled in series with the load, and its operating principle is also based on the volt-ampere characteristics of the coil. Equations are derived to determine the output of the choke, the maximum voltage at the coil terminals, the maximum voltage drop across the capacitor, and the capacitance of the capacitor. Transl. by R.B.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N70-11487# Boeing Co., Renton, Wash. Commercial Airplane Div.
DEVELOPMENT OF A HIGH SPEED INDUCTION TYPE WIND TUNNEL
S. Strandbygaard 1 Sep. 1969 105 p refs
(AD-693615; T6-5514) Avail: CFSTI CSCL 14/2

The document describes the design, construction and operating performance of a high speed (0.8 Mach) open circuit induction type wind tunnel. The tunnel was developed primarily to test ram air submerged scoops used in heat exchange cooling systems. A tunnel wall simulates the airplane surface for this type of test. An instrumentation system was developed to record pressures for evaluating boundary layer parameters, ram air system wake drag and internal performance. Author (TAB)

N70-11497# Ballistic Research Labs., Aberdeen Proving Ground, Md. Terminal Ballistics Lab.
BRL DUAL SHOCK TUBE FACILITY
Brian P. Bertrand Aug. 1969 36 p
(AD-693264; BRL-MR-2001) Avail: CFSTI CSCL 14/2

The Dual Shock Tube Facility was constructed for use in evaluating the performance of large engine-generator sets operating in a shock wave environment such as would occur during a nuclear attack. The design and operation of the facility are described and results of shock tube operation are presented. Author (TAB)

N70-11636*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE DETERMINATION AND COMPARISON OF THE GRARR MADGAR SITE LOCATION
Francis J. Lerch, Clarence E. Doll, Samuel J. Moss (Wolf Res. and Develop. Corp., College Park, Md.) and Brian O'Neill (Wolf Res. and Develop. Corp., College Park, Md.) Washington Nov. 1969 15 p ref
(NASA-TN-D-5033) Avail: CFSTI CSCL 22C

Improved coordinates for the Goddard Range and Range Rate station at Madagascar (MADGAR) range and rate site have been estimated from GEOS I data sets using the NONAME Orbit Determination Program. These coordinates have been compared with a preliminary estimate by the Applied Physics Laboratory using 39 passes of AN/SRN-9 Doppler data from three satellites. Two independent estimates were obtained using the NONAME Orbit Determination Program; one was from optical flash sequence data taken at the Minitrack Optical Tracking Station located at Madagascar and the other from range measurements taken at MADGAR. The comparison is shown by plots of the residual differences of the range and rate measurements from five reference orbits determined solely from optical flash sequence data, and having a maximum root mean square of fit of less than 2 seconds of arc. The residual differences for both range and range rate measurements clearly indicate that a significantly better set of MADGAR coordinates was obtained from the NONAME Orbit Determination Program. Author

N70-11652# Army Foreign Science and Technology Center, Washington, D.C.
PERFECTING THE DESIGN AND TECHNOLOGY OF THE CONSTRUCTION OF REINFORCED CONCRETE AIRDROME PAVEMENTS
F. F. Kostandi et al 13 Aug. 1969 16 p Transl. into ENGLISH from Avtomob. Prom (Moscow), no. 6, 1966 p 8–10
(AD-692933; FSTC-HT-23-68-69) Avail: CFSTI CSCL 13/2

Tests made in laying reinforced concrete airdrome pavements by SOYUZDORNII, where the installation of reinforcement wire elements is mechanized by the use of a self-propelled machine, are described and analyzed. The authors conclude that the method employed was insufficiently mechanized, involving too much labor-consuming auxiliary tasks. Author (TAB)

N70-11662*# Nortronics, Huntsville, Ala.
STATIC AND DYNAMIC CALIBRATIONS OF MSFC'S PLUG-NOZZLE SPECIAL TEST SECTION (REDESIGNED 1967)
S. V. Paranjape, J. J. Mc Gowen, III (NASA, Marshall Space Flight Center), and H. A. Cikanek, Jr. Jan. 1969 80 p refs
(Contract NAS8-20082)
(NASA-CR-61312; HTR-794-9-433) Avail: CFSTI CSCL 14B

This report presents static calibration and evaluation of the dynamic response characteristics of MSFC's 14-inch wind tunnel plug-nozzle special test section, which was redesigned in 1967. This test was performed to calibrate the facility in support of the wind tunnel aerodynamic cross-beam program and to provide pre-test information necessary for conduction of fluctuating pressure experiments. Mach number distribution across the test section flow annulus was determined, and measured deviations were found to be well within instrumentation error. A range of test section Mach numbers from M = 1.97 to 2.78 were investigated

in the study and are shown to vary linearly with hand-crank settings. The hand crank is gear-linked to a movable outer wall and regulates throat area with respect to a fixed plug, and, hence, Mach number. The test revealed unwanted correlated photometer output fluctuations, which were probably caused by mechanical vibrations of the outer wall, periodic pressure fluctuations in the window cavity and the acoustic environment outside the tunnel. These vibrations caused large noise and meaningless correlated fluctuations in the signal. We now know from later tests that such adverse signal components could have been reduced by modifying the electronics and the recording process. Since the shortcomings in the crossed-beam electronics have now been overcome a new test to determine the feasibility of making successful crossed-beam measurements in the special test section may be warranted. Author

N70-11707# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DEVICE FOR AUTOMATIC CONTROL OF A SUPERSONIC WIND TUNNEL

A. Ts. Bosis et al 18 Jun. 1969 4 p Transl. into ENGLISH from Russian Patent No. 210915 (Appl. no. 1122934/40-23, 16 Dec. 1966)

(AD-693486; FTD-HT-23-193-69) Avail: CFSTI CSCL 14/2

A device is decribed for the automatic control of a supersonic wind tunnel, consisting of pressure regulators in the mixing chambers and ejectors, a programming mechanism with a drive for moving the line of direction of the diffuser, a gage for measuring the pressure of the unperturbed current programming mechanisms for conducting the experiment, recorders to register the measured parameters of the studied object, and a device for controlling the pressure in the mixing chamber and in the ejectors at given starting and operating pressure levels before the operation of the wind tunnel. To increase reliability and measurement accuracy while conducting an experiment, it is equipped with two pneumoelectric relays and an electromagnetic slide valve with two outlets. One of these outlets is connected with the intake of the mixing chambers pressure regulator, and to the second outlet is connected the intake of the gage for measuring pressure the undisturbed current; the intake of the electromagnetic slide valve is connected with the adjustment controller of the mixing-chamber and ejector pressure regulators. Author (TAB)

N70-12172# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

PERFORMANCE ESTIMATES FOR A REFLECTED-SHOCK TUNNEL WITH A MODIFIED DRIVER TO PRODUCE HIGH TEST-SECTION REYNOLDS NUMBERS

J. G. Woodley 1969 40 p refs Supersedes RAE-TR-68272; ARC-31263

(ARC-CP-1057; RAE-TR-68272) Avail: HMSO 9s; BIS $1.80

Some calculations based on the performance of an ideal shock-tube are presented. These demonstrate the possibility of achieving a high test-section Reynolds number in a reflected-shock tunnel, employing nitrogen or air as the test gas, by the use of a driver gas composed of a mixture of hydrogen and nitrogen. Author (ESRO)

N70-12200# Grenoble Univ. (France). Faculté des Sciences.

CONTRIBUTION TO THE EXPERIMENTAL STUDY OF A FREE PISTON COMPRESSOR [CONTRIBUTION A L'ETUDE EXPERIMENTALE D'UN COMPRESSEUR A PISTON LIBRE]

Daniel Auchere (Ph.D. Thesis) Feb. 1969 116 p refs In FRENCH

Avail: CFSTI

Compression in a gun tunnel is not isentropic but dependent on the displacement of the piston. A device has been designed to analyze the trajectory of the piston inside the tube. Several methods are discussed, but a special emphasis is given to a magnetic method. Magnetic coils are included in the piston and magnetic sensors situated outside the tube are used to record the movement of the piston. Two arrangements are necessary, one on the part of the tube where the piston travels at a more or less uniform speed and one for the end of the tube where the movement becomes oscillating. The signal processing equipment is described and accuracy of measurements discussed. ESRO

N70-12227# Royal Aircraft Establishment, Farnborough (England).

COMPUTER PREPARATION OF A FREQUENCY ASSIGNMENT PLAN FOR VHF AIR-GROUND COMMUNICATION CHANNELS

P. P. Scott Apr. 1969 57 p ref

(RAE-TR-69064) Avail: CFSTI

In the European-Mediterranean region the frequencies available for use by air traffic services(ATS) communication channels seem likely to reach saturation point in the near future because of increasing traffic and the resulting increase in controller workload. At present the frequencies required for international facilities are assigned by manual methods by the International Civil Aviation Organization, and the question has arisen of the feasibility of using a computer to make a complete re-assignment plan. This report gives the results of investigations into this possibility. The conclusion drawn is that it appears that computer methods can improve on results obtained manually. Author (ESRO)

N70-12328# Air Force Missile Development Center, Holloman AFB, N.Mex.

DEVELOPMENT OF A NINE INCH DIAMETER, MACH 5.5, MONORAIL ROCKET SLED

Daniel J. Krupovage and Berle E. Engle Jun. 1969 51 p refs

(AD-692733; MDC-TR-69-41) Avail: CFSTI CSCL 14/2

A nine inch diameter monorail rocket sled was designed, fabricated and tested at Holloman Air Force Base. The vehicle was designed to allow easy replacement of appendages which were subject to severe aerodynamic heating and/or high wear rates. The monorail vehicle as described was shown to be a capable of reaching 6200 feet per second and of being recovered with water brake entrance velocities up to 2000 feet per second. Drag coefficients up to Mach 5 were obtained and are presented in this report. Author (TAB)

N70-12363# European Space Sounding Rocket Range, Kiruna (Sweden).

EUROPEAN SPACE RANGE INSTRUMENTATION GROUND FACILITIES

R. Balvay, A. Chofflet, and P. Durdeyte Paris ESRO Nov. 1968 99 p

(ESRO-TN-84) Avail: CFSTI

The purpose of this document is to provide information for the users of the European Space Research Organisation sounding rockets launching range (ESRANGE) concerning the ground facilities available to them within the instrumentation and data division of the range. The equipment for localisation, telemetry reception, scientific data, communication and synchronisation are described in detail, together with their essential characteristics. The maintenance and calibration laboratory for the electronic test equipment is also briefly described. The main text is followed by a series of explanatory tables and figures, as well as photographic illustrations. A model form, constituting the technical annex to the contract binding ESRO to the users and covering the services furnished by the instrumentation and data division, is attached as an appendix. Author (ESRO)

N70-12383# Parsons (Ralph M.) Co., Los Angeles, Calif.

EVALUATION OF CONSTRUCTION METHODS FOR OFFSHORE AIRPORTS Final Report

Aug. 1969 383 p refs Prepared in cooperation with Tetra Tech., Inc.

(Contract FA-69-WA-2073)

(AD-693185; SRDS-RD-69-42) Avail: CFSTI CSCL 1/5

The report presents a narrative summary and evaluations of existing and proposed offshore airports and related construction.

Four primary construction methods - dike and polder, fill, pile and floating - are discussed. Airport planning considerations are treated, with particular emphasis on factors peculiar to the offshore airport. Ranges of unit costs for construction of an offshore site, by the various construction methods, are compared. Area requirements, by function, for a typical offshore airport are described. Methods of access are discussed, as well as unit costs for various access systems. Author (TAB)

N70-12384# Parsons (Ralph M.) Co., Los Angeles, Calif.
OFFSHORE AIRPORT PLANNING Final Report
Aug. 1969 202 p refs Prepared in cooperation with Tetra Tech., Inc.
(Contract FA-69-WA-2073)
(AD-693172; SRDS-RD-69-41) Avail: CFSTI CSCL 1/5

The document provides planning guidance to local, state, and regional authorities and interested planners concerned with development of airports in offshore marine environments. Basic planning factors are established and site evaluation methodology is suggested. Also provided are parameters to determine desirability of an offshore location and, if desirability is established, the types of construction and methods of access that may be used. Author (TAB)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N70-11416*# North American Rockwell Corp., Downey, Calif. Space Div.
NONISENTROPIC FINITE-AMPLITUDE WAVE GENERATION Final Report, Jul. 1968 - Apr. 1969
Abraham C. Peter 16 Apr. 1969 76 p refs
(Contract NAS8-21406)
(NASA-CR-106807; SD-69-168) Avail: CFSTI CSCL 20D

The problem of acoustic shock emission of high-speed nozzles is discussed in terms of the theoretical aspects of nonisentropic wave generation. Some of the recent developments in the analytical and computational aspects of the problem are presented with emphasis upon exhaust shocks of conical structure. Initial efforts to isolate the mechanism of shock emission in terms of nonisentropic sources indicate that local velocity fluctuations are of second-order magnitude and serve as a triggering device rather than as actual acoustic flow sources. The physical effects of irreversibility of nozzles was examined by extending the nonisentropic unsteady wave theory to steady processes. It is shown that classical theories are able to account only for stagnation initial conditions. Author

N70-11421# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EXPERIMENTAL AND NUMERICAL NONEQUILIBRIUM FLOW STUDIES
Joseph H. Spurk May 1969 38 p refs
(AD-692829; BRL-1445) Avail: CFSTI CSCL 20/4

Experimental and numerical studies of the nonequilibrium shock layer around cones in hypersonic pure oxygen flows are reported. Experimental conditions are such that rotational, vibrational and dissociation relaxation occur simultaneously. Attention is given to the effect of coupled relaxation on the flow properties in the shock layer. The phenomenological models of Hammerling, et al, and Treanor and Marrone predict the flow field qualitatively correct. However, quantitative differences in shock geometry and density distribution are appreciable. Better quantitative agreement with experiment is reached in these models a temperature dependent efficiency of O2 and O in the relaxation processes is assumed. Author (TAB)

N70-11522# Michigan Univ., Ann Arbor. Gas Dynamics Labs.
WALL PRESSURE FLUCTUATIONS BENEATH AN AXIALLY SYMMETRIC TURBULENT BOUNDARY LAYER ON A CYLINDER
Chi-Sheng Yang and William W. Willmarth Aug. 1969 112 p refs
(Contract N00014-67-A-0181)
(AD-693508; Rept-02149-1-T) Avail: CFSTI CSCL 20/4

Measurements of the turbulent pressure field on the outer surface of a 3 inch diameter cylinder were made at a point 24 feet downstream of the origin of the turbulent boundary layer. The root-mean square wall pressure was 2.42 times the wall shear stress. The normalized power spectrum at high frequencies contained twice the energy density of the spectrum beneath a plane boundary layer. The convection speed was the same as that in a plane boundary layer but the eddy size was smaller by a factor of two. The smaller eddy size and unchanged convection speed account for the greater energy in the spectrum at high frequencies. Author (TAB)

N70-11523# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A METHOD OF CALCULATING A RETURN CIRCUIT RIG WITH CYLINDRICAL BLADING CONFIGURATIONS ACCORDING TO A GIVEN RADIAL PRESSURE GRADIENT
Ya. I. Shnee et al 15 May 1969 14 p refs Transl. into ENGLISH from Kharkov. Politekh. Inst. Power Machinery Construct. (Russian), no. 5, 1967 p 24-29
(AD-693658; FTD-HT-23-62-69) Avail: CFSTI CSCL 21/5

Approximate method is presented for calculating an inverse problem of the axisymmetric flow of a compressible fluid in a blade apparatus with cylindrical boundaries and a constant blockage (the constriction of the interblade passage) along the radius t/b equals const). Since it was not possible to obtain satisfactory results by using successive approximations, the Euler motion equation including derivatives of the radial velocity component was used in this method. It is assumed that the geometrical parameters of the cascade were given and that the working medium flow rate at the mean radius practically equaled the actual flow rate. The total parameters and the distribution of the specific flow rates at the stage inlet and the compression coefficients in the cascade volume were also given. The problem was solved by using a fixed grid and by dividing the cascade meridional projections into n sections along the z-axis and into k segments along the radius. Author (TAB)

N70-11536# Purdue Univ., Lafayette, Ind. Cornell Aeronautical Lab., Inc., Buffalo, N.Y. School of Mechanical Engineering.
GAS PARTICLE FLOW IN CONVERGENT NOZZLES AT HIGH LOADING RATIOS
George Rudinger Jul. 1969 41 p refs Prepared in cooperation with Cornell Aeron. Lab., Inc.
(Contract N00014-67-A-0226)
(AD-693056; CAL-98-PU) Avail: CFSTI CSCL 21/8

Nozzle flows of gas-particle mixtures are analyzed for particle loadings for which the particle volume may not be negligible. Nozzle shapes are such that the particle velocity is a constant fraction of the gas velocity. The influence of various parameters which enter into the analysis is discussed. For loading ratios greater than about five, the gas and particle temperatures remain substantially constant for the entire flow, and the assumption of isothermal flow reduces the flow equations to algebraic relationships. Throat conditions then can be obtained directly without having to compute the entire flow. A procedure is outlined to evaluate the ranges of the loading ratio for which the assumption of either isothermal flow or of negligible particle volume keeps errors below a desired level, and it is found that these ranges may overlap. An important intermediate range of the loading ratio therefore exists, typically from about five to fifty, for which both simplifying assumptions are permissible with a resultant extreme simplification of the relationships. Author (TAB)

N70-11552# Naval Ship Research and Development Center, Washington, D.C.
COMPUTATIONAL METHOD FOR DETERMINATION OF BUBBLE DISTRIBUTIONS IN LIQUIDS Final Report
Terry Brockett Apr. 1969 75 p refs
(AD-693445; NSRDC-2798) Avail: CFSTI CSCL 20/4

An analytical method of determining the gas bubble spectrum in a liquid from the measured acoustic attenuation is examined. The analysis is based on the linearized equations of motion for a spherical bubble with damping. The bubbles are assumed to be homogeneously distributed in the liquid and the bubble concentration and damping are assumed constant in a small size interval. The acoustic wavelength is assumed much greater than the bubble dimensions and bubbles are assumed far enough apart that no interactions occur. The direct solution gives the acoustic attenuation of a known bubble distribution at any given frequency. An iteration procedure is incorporated in a FORTRAN program for converting acoustic attenuation as a function of frequency to bubble concentration as a function of size. For air bubbles in water, the effects of physical properties on the bubble spectrum are examined with the computer program. Experiments in a 12-inch water tunnel are described. Author (TAB)

N70-11553# Politecnico Di Torino (Italy). Istituto di Meccanica Applicata Aerodinamica e Gasdinamica.
BASIC PROBLEMS IN THE INTERACTION BETWEEN GAS AND BODY, AND AEROSPACE APPLICATIONS
Silvio Nocilla Jun. 1969 32 p refs
(Grant EOOAR-68-0049)
(AD-693342; SR-2; TN-48; AFOSR-69-2171-TR) Avail: CFSTI CSCL 20/4

The report concerns surface interaction in free-molecule flow as regards both aerospace applications and molecular beams and adsorption phenomena. The most important magnitudes related to this basic phenomenon are examined as the classical accommodation coefficients, the sitting time of molecules over the surface, and the velocity distribution function of the free-molecule surface source formed by the re-emitted molecules. Successively, the most recent theoretical and experimental methods used for studying surface interaction are examined, together with aerospace applications to the calculation of pressures and drag coefficients on missiles moving in the upper atmosphere. Author (TAB)

N70-11585# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
A SYSTEM FOR THE GENERATION AND MEASUREMENT OF CAPILLARY GRAVITY WAVES
L. F. Mc Goldrick Aug. 1969 42 p refs
(Contract N00014-67-A-0285)
(AD-693114; TR-3) Avail: CFSTI CSCL 20/4

It is the purpose of the report to describe in some detail a method for the laboratory generation of surface waves for which the effect of surface tension as a restoring force is comparable to that of gravity. Particular attention is paid to the stability of the amplitude and frequency of the waves generated. A wave probe, nominally of the familiar capacitance type, for the measurement of the waves produced is described. An inexpensive, but ultra-linear highly sensitive transistorised detector has been developed, and the circuit description and operation are included here. Author (TAB)

N70-11585# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Aerospace Sciences.
BOUNDARY LAYER STABILITY AND TRANSITION
Eli Reshotko Jul. 1969 45 p refs Presented at the Conf. on Boundary Layer Concepts in Fluid Mech., Amherst, Mass., 30-31 Jul. 1969
(Grant AF-AFOSR-1581-68)
(AD-693617; AFOSR-69-2330TR) Avail: CFSTI CSCL 20/4

A review is given of boundary layer stability and transition. The normal modes procedures as they apply to boundary layers are briefly reviewed and the mechanism of instability is discussed. It is shown how normal modes results may be used to give guidance regarding the factors affecting transition. Some remarks are made about the prediction of transition and about the fixing of transition. It is concluded that the process of transition from laminar to turbulent flow remains unsolved. However, significant inroads into inroads into the understanding of transition are now possible because of our ability to do sophisticated theoretical and experimental studies of the stability of laminar boundary layers. Author (TAB)

N70-11587# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
FINITE ELEMENT ANALYSIS FOR LIQUID SLOSHING PROBLEMS
Chih-Hung Luk May 1969 97 p refs
(Contract F44620-67-C-0019)
(AD-693619; ASRL-TR-144-3; AFOSR-69-1504TR) Avail: CFSTI CSCL 22/2

The purpose of this report is to determine the natural frequencies of an incompressible, inviscid fluid in a rigid or a flexible axisymmetric shell container by a finite element method. In the analysis the liquid portion is subdivided into the concentric triangular annular elements. The free surface and the container are assumed to be made of a series of meridionally curved frusta connected at nodal points. The interpolation functions for the velocity potential of the fluid and the displacements of the free surface and the shells have been assumed. The liquid sloshing motions in a conical, a hemispherical and a circular cylindrical container have been studied in detail. The sloshing frequencies and its mode shapes have been presented. The figures clearly demonstrate the convergence of the numerical results to the exact solution as the sizes of the elements decrease. It also reveals that the flexibility of the container always lowers the sloshing frequencies. Author (TAB)

N70-11594# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
EXPERIMENTAL MEASUREMENTS OF HYPERSONIC CORNER FLOW
Charles T. Nardo and Robert J. Cresci Jan. 1969 54 p refs
(Contract AF 49(638)-1623)
(AD-693631; PIBAL-69-1; AFOSR-69-1228TR) Avail: CFSTI CSCL 1/3

An experimental investigation has been conducted of the viscous-inviscid interaction occurring along the interior corner of two intersecting flat plates under hypersonic, low density, conditions. The program involves the measurement of surface heat transfer rates and surface pressures in the vicinity of a corner with included angles of 60 degrees, 90 degrees and 120 degrees. The interpretation of these measurements gives rise to some understanding of local flow behavior and, therefore, on the nature of the three-dimensional boundary layer and shock shape within the corner region. In addition, pitot and temperature surveys are conducted in cross planes to obtain information pertaining to the flow field variables within the corner region, and also, the complex shock configuration which extends into the viscous layer. This data is presented on contour maps in order to facilitate easier visual interpretation. Author (TAB)

N70-11607*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INVESTIGATION OF LAMINAR AND TURBULENT BOUNDARY LAYERS INTERACTING WITH EXTERNALLY GENERATED SHOCK WAVES
Earl C. Watson, John D. Murphy, and William C. Rose Washington Nov. 1969 133 p refs
(NASA-TM-D-5512) Avail: CFSTI CSCL 20D

Laminar and turbulent boundary layer interactions with externally generated shock waves are investigated. The study included tests at nominal free stream Mach numbers of 7.3 and 10.4 as well as a comprehensive review of previous work by others in related areas. The studies considered interactions that occurred on

two different models: a flat plate and a curved surface that provided isentropic compression of the flow. Each model had a sharp leading edge; the contour of the compression surface was representative of that for a hypersonic inlet. Data were examined to determine parameters that correlated significant features of the interactions. The data considered from the present and other investigations cover a range of free stream Mach numbers from 2 to 15 and free stream Reynolds numbers per foot 200,000 to 10 to the 7th power. It is concluded that further work needs to be done before details of the interactions, such as shock configuration, mass entrainment in the boundary layer, and changes in boundary layer parameters across an interaction can be well defined. Author

N70-11637*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

BLADE-ELEMENT PERFORMANCE OF A TANDEM-BLADED INDUCER TESTED IN WATER

Richard F. Soltis, Donald C. Urasek, and Max J. Miller Washington Nov. 1969 36 p refs

(NASA-TM-D-5562; E-4949) Avail: CFSTI CSCL 20D

A tandem-bladed inducer was tested in water. The three-bladed inducer was 6.5 in. in diameter at the inlet, and the blade sections were formed by radial elements. The design values of flow coefficient and head-rise coefficient were 0.109 and 0.303, respectively. The radial distributions of performance and flow parameters across the tandem-blade elements are presented for a range of flow rates under both noncavitating and cavitating conditions. At design flow, the design level of head-rise coefficient was attained in the blade tip region. Measurements indicated that blade-element efficiencies varied from approximately 97 percent at the hub to 75 percent at the tip. Author

N70-11700# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.

THE PROPAGATION AND STRUCTURE OF IONIZATION WAVE FRONTS

R. W. Munt, R. S. Ong, and D. L. Turcotte Jul. 1969 128 p refs

(Grant AF-AFOSR-825-67)

(AD-693642; Rept-0858)-1-T; AFOSR-69-2011TR) Avail: CFSTI CSCL 20/4

The propagation and structure of an ionization wave are investigated. In the analysis the ionization wave is treated much like an ordinary laminar flame front. However, due to the endothermic nature of the reaction an external energy source is postulated to ensure a steady state solution. That source is taken to be the Joule heating which arises from an applied transverse electric field. Low levels of ionization are considered and collisional processes are assumed for the ionization and recombination reactions. A solution is obtained only in the ambi-polar diffusion regime. In the absence of a magnetic field the solution shows that the wave speed is of the order of the electron sound speed times the square root of the ratio of the electron collision time to the reaction time. A well defined wave structure is also found whose width is of the order of the ionization length. When a magnetic field is present a dynamic analysis of the problem (i.e., without regard to the energy effects) which considers magnetic induction leads to a solution which is a degenerate case of the ionizing shock problem. Author (TAB)

N70-11709*# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.

DEVIATION ANGLE PREDICTION METHODS: A REVIEW Interim Report

Max J. Miller Oct. 1969 63 p refs

(Grant NGL-16-002-00; Proj. 407-S)

(NASA-CR-106959; ERI-580) Avail: CFSTI CSCL 20D

Predicting the direction of flow leaving an annular cascade of blades is a key problem in axial-flow turbomachinery. A review is presented of methods which have been proposed for the prediction of deviazion angles in axial-flow pumps and compressors. A large number of variables influence deviation angle. However, methods of predicting the effects of many variables have not been published, hence this review was limited to the effects of: two-dimensional geometric parameters, incidence angle, axial velocity ratio, secondary flow, and sweep and dihedral. Author

N70-11740# Politecnico di Torino (Italy). Istituto di Meccanica Applicata Aerodinamica e Gasdinamica.

STRUCTURE OF A STRONG NORMAL SHOCK WAVE DUE TO NONEQUILIBRIUM RADIATION AND COLLISIONAL IONIZATION

Carlo Ferrari and Michele Onorato Mar. 1969 41 p refs

(Grant EOOAR-68-0049)

(AD-692882; SR-1; TN-47; AFOSR-69-2101-TR) Avail: CFSTI CSCL 20/4

The general theory about gas-dynamics with nonequilibrium radiative and collisional ionization is applied to the strong normal shock wave. It is shown that the problem is reduced to the solution of a system of two non-linear integral equations. It is proved that, if certain conditions are satisfied, an iteration method, to resolve these equations, can be applied. It turns out then that the fundamental parameter controlling the convergence or non convergence of the procedure is the value of the degree of ionization just on the front of the shock. Numerical results are given and the physical complete structure of the shock is analyzed. Author (TAB)

N70-11745 France. Ministere de l'Air, Paris.

THE WAVE OF THE FOURTH ORDER OF FANION, FISH UNDULATIONS, AND NORMAL FLIGHT [L'ONDE (DU 4E ORDRE) DE FANION, ONDE DU POISSON ET DU VOL EN REGIME]

Francois-Joseph Bourrieres 1969 132 p refs In FRENCH *Its* no. 448

Copyright. Avail: Issuing Activity

Aeroelastic, self-oscillating fluid systems with infinite degrees of freedom, and a single independent spatial parameter was investigated. Correspondence in a mathematical – physical equation in the linear wave of Fanion is set forth. The linear wave is partially derived from the fourth order of two independent variables; it is based on the Fanion effect in nature describing the undulations of the vocal cords and, in reversible form, the undulations of fish schools and normal avian flight patterns. An indifference theory for streaming reactions in elastic materials or fluids is also part of the final equation. Experiments on the physical and analytical degeneration of self-propagating, energetic waves are discussed using an end-overloadad bar and an ordinary bar. New invariants in wave characteristics were determined. Transl. by M.H.E.

N70-11794*# Texas A&M Univ., College Station. Engineering Experiment Station.

APOLLO WATER IMPACT Status Report, 1 Apr. – 1 Oct. 1969

C. F. Kettleborough Oct. 1969 13 p refs

(Grant NGR-44-001-071)

(NASA-CR-106974) Avail: CFSTI CSCL 20D

This report describes the status of the computer program being developed to simulate the impact of a right circular cylinder on a smooth water surface, and the experimental equipment and methods. Author

N70-11813# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE THEORETICAL INVESTIGATIONS OF SEPARATED FLOWS

Yu. A. Panov et al 5 May 1969 10 p refs Transl. into ENGLISH from Gidroaeromekh. (USSR), no. 7, 1968 p 18 – 26

(AD-693603; FTD-HT-23-1507-68) Avail: CFSTI CSCL 13/11

This article presents a theoretical analysis of separated flows near steps and recesses on the basis of various available

theoretical and experimental data. Flows in three characteristic regions are considered: (1) a region of boundary layer-shock wave interaction; (2) a region of a developed laminar flow; and (3) a flow near the obstacle. Equations of a uniform viscous compressible gas flow into a space with a liquid at rest are written with certain boundary conditions and assuming the absence of a boundary layer. Profiles of velocity and flow parameters on the dividing streamline, obtained from the above equations, are used for calculating base pressure by the Chapman-Korst method. The effect of the initial boundary layer on calculations of base flow properties is discussed. Prandtl and Taylor models of the turbulent flow are used for determining the turbulent mixing. Profiles of velocities in terms of similarity parameter and the dependence of base pressure of Reynolds number, based on the boundary-layer momentum thickness obtained by Denison and Baum, are discussed. The use of laminar and turbulent profiles having a point of inflection for calculating heat transfer in the stagnation region is considered. Author (TAB)

N70-11865# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.

VISCOUS FLOW ALONG A CORNER. PART 1. ASYMPTOTIC FEATURES OF THE CORNER LAYER EQUATIONS

Alexander Pal and Stanley G. Rubin May 1969 44 p refs
(Contract AF 49(638)-1623)
(AD-693630; PIBAL-69-18-Pt-1; AFOSR-69-1225-TR) Avail: CFSTI CSCL 20/4

The asymptotic behavior of the equations governing the viscous flow along a right-angle corner is considered. It is demonstrated that consistent asymptotic series exist for the inner corner layer region. These expansions satisfy the corner layer equations and associated boundary conditions. They exhibit algebraic decay of all the flow properties into the boundary layer away from the corner, and prescribe algebraic decay of the cross flow velocities into the outer potential flow. Of course, the streamwise velocity and vorticity are constrained to decay exponentially into the potential flow. The form of this algebraic behavior is required in order to facilitate numerical solution of the corner layer equations. Of particular significance is the use of symmetry as a means of providing a boundary condition, predicting the appearance of logarithmic terms, and specifying the occurrence of arbitrary constants. These constants can only be determined from the complete corner layer solution. Author (TAB)

N70-11894*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

RESULTS OF AN EXPERIMENTAL TURBULENT BOUNDARY LAYER CONTROL INVESTIGATION

William W. Clever, II 11 Sep. 1969 40 p refs
(NASA-TM-X-53899) Avail: CFSTI CSCL 20D

Results of a wind tunnel test employing wall roughener as a means of turbulent boundary layer control are presented. This method is demonstrated as being simple, efficient, and capable of yielding predictable results. Boundary layer thickness increases on the order of 100 percent are shown to be possible without undue flow disturbance and velocity profile distortion. The results are compared with the theoretical growth of a turbulent boundary layer over a flat plate. Author

N70-11903# Bureau of Mines, Amarillo, Tex. Helium Research Center.

ON ESTIMATING VIRIAL COEFFICIENTS FROM EXPERIMENTAL DATA

K. R. Van Doren Dec. 1969 29 p refs
(BM-IC-8437) Avail: CFSTI

The polynomial method for estimating virial coefficients from experimental data suffers from three serious defects: (1) There is no known relationship between the polynomial coefficients and the virial coefficients. (2) The values of the estimates depend upon the degree of the polynomial and the particular set of values used for the independent variable, as well as the random errors in the dependent variable. (3) The variances calculated for the estimates do not represent the mean square errors of estimation. Attempts to overcome these defects have thus far been unsuccessful; these attempts have also failed to account for the fact that none of the virial coefficients are uniquely determined by the values of the dependent variable for a finite set of values of the independent variable. The conclusion is that virial coefficients cannot be reliably estimated from experimental data unless additional information about the virial expansion itself, such as its rate of convergence, is available. Author

N70-11914# Watervliet Arsenal, N.Y. Benet R and E Labs.

A THEORETICAL DESCRIPTION OF THE PROCESS OF CHARGING AND DISCHARGING A BORE EVACUATOR CHAMBER

Richard W. Clarke Sep. 1969 42 p
(AD-692866; WVT-6938) Avail: CFSTI CSCL 19/6

The gas dynamics of a gun tube bore evacuator system or a gun gas operated chamber scavenger system may be theoretically described by ideal compressible follow relations. Differential equations and driving functions necessary to completely describe the operation of an evacuator system are developed based on the assumption of ideal adiabatic isentropic flow. A method of computer solution is proposed. Theoretical measures of scavenger effectiveness are presented. Author (TAB)

N70-11938*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

RESULTS OF AN EXPERIMENTAL TURBULENT BOUNDARY LAYER CONTROL INVESTIGATION

William W. Clever, II 11 Sep. 1969 40 p refs
(NASA-TM-X-53099) Avail: CFSTI CSCL 20D

Results of a wind tunnel test employing wall roughener as a means of turbulent boundary layer control are presented. This method is demonstrated as being simple, efficient, and capable of yielding predictable results. Boundary layer thickness increases on the order of 100 percent are shown to be possible without undue flow disturbance and velocity profile distortion. The results are compared with the theoretical growth of a turbulent boundary layer over a flat plate. Author

N70-11939*# City Coll. of the City of New York.

CASCADE MODEL OF TURBULENCE

C. M. Tchen Nov. 1969 35 p refs
(Grant NGR-33-013-034)
(NASA-CR-106911) Avail: CFSTI CSCL 20D

This concept decomposes a velocity fluctuation into a group of modes of large scales and a group of modes of smaller scales. The mutual interaction is responsible for the transfer of energy across the spectrum. The concept of cascade has the purpose of providing a mean of closure of the hierarchy of equations common to nonlinear systems. A new expression for the eddy viscosity is obtained, differing from that proposed by Heisenberg. It has the advantage of determining the Kolmogoroff law in the inertial subrange with an analytical numerical coefficient, and of calculating the spectral law in the viscous subrange. The latter law provides a cutoff in the spectrum and therefore secures the convergence of any high order velocity derivative. The cutoff follows the viscous subrange, and does not follow the inertial law, as predicted by some theories. Author

N70-12019# Army Foreign Science and Technology Center, Washington, D.C.

SUPERSONIC GAS FLOW PAST BLUNT BODIES. THEORETICAL AND EXPERIMENTAL STUDIES

O. M. Belotserkovskiy, ed et al. 1969 583 p refs Transl. into ENGLISH of the publ. "Obtekanie Zatuplennykh Tel Sverkhzvukovym Potokom Gaza Theoreticheskoe i Eksperimentalnoe Issledovaniya" Moscow, Izd. AN SSSR, 1967 Revised.
(AD-693287; FSTC-HT-23-447-68) Avail: CFSTI CSCL 16/3

Over a number of years formulation of numerical algorithms for calculating flow past blunt bodies with detached shock wave has been underway in the Computation Center of the USSR Academy of Sciences and the Leningrad Engineering Physics Institute. This review dwells on several features in the use of the method of integral relations for this problem and describes the construction of numerical algorithms, and demonstrates their use for various cases of streamline flow. Author (TAB)

N70-12042*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF STEADY VELOCITIES ON THE DYNAMIC RESPONSE OF LIQUID JET ATOMIZATION

Marcus F. Heidmann Washington Dec. 1969 20 p refs

(NASA-TN-D-5565) Avail: CFSTI CSCL 20D

The effect of steady axial, tangential, and radial velocities on the dynamic response of liquid jet atomization rate to pressure oscillations in a traveling transverse acoustic mode is analyzed. High axial velocity differences between the liquid and gas degrade the response. Tangential velocities in the direction of wave travel and radial velocities either toward the center or wall significantly increase peak response properties, whereas counterwave tangential flows suppress the response. The results imply that injection velocities and any lateral velocities caused by nonuniform propellant distribution, acoustic streaming, or acoustic damping devices can affect the stability of rocket combustors. Author

N70-12174# Grenoble Univ. (France). Faculté des Sciences.

CONTRIBUTION TO THE STUDY OF SOME NON-NEWTONIAN FLUIDS [CONTRIBUTION A L'ETUDE DE CERTAINS LIQUIDES NON NEWTONIENS]

Philippe Le Roy (Ph.D. Thesis) 4 Jul. 1968 117 p refs In FRENCH

Avail: CFSTI

Known results concerning tensors expressed in a natural reference field are extended to tensors expressed in any reference field and then to an orthonormalized field for each point of the space. These rheological laws are applied to steady flow with both rectilinear and circular trajectories. In the latter case three types of velocity distribution are analyzed: plane, cylindrical and conical. ESRO

N70-12190# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genèse (Belgium).

ON SOME PROPERTIES OF REATTACHING LAMINAR AND TRANSITIONAL HIGH SPEED FLOWS

Jean J. Ginoux Sep. 1969 69 p refs Presented at the Intern. Seminar on Heat and Mass Transfer in Flows with Separated Regions, Herceg-Novi, Yugoslavia, 1969

(VKI-TN-53) Avail: CFSTI

This paper is a review of some of the work done at the von Karman Institute over the past years on separated flows. Emphasis is given to a fundamental phenomenon developing in attaching high speed flows, namely, spatially periodic patterns of counter-rotating streamwise vortices. Detailed surveys made with pitot-static tubes, hot wire probes, recovery temperature and heat transfer gages are presented. The effect of streamwise vortices on transition was studied using axisymmetric models on which the strength of vortices could be artificially controlled. For this purpose, a new criterion for transition detection was used. The effect of air and foreign gas injection in separated flow was studied and its application to suppressing local heat transfer peaks examined. Author (ESRO)

N70-12218*# United Aircraft Corp., East Hartford, Conn. Research Labs.

EXPLORATORY EXPERIMENTAL STUDY OF THE EFFECTS OF INLET CONDITIONS ON THE FLOW AND CONTAINMENT CHARACTERISTICS OF COAXIAL FLOWS

Bruce V. Johnson Sep. 1969 50 p refs

(Contract NASw-847)

(NASA-CR-107051; H-910091-21) Avail: CFSTI CSCL 20D

Fluid mechanics experiments were performed to investigate the factors which influence the formation and growth of the large eddy structure in developing coaxial shear flows. Information from these experiments was used to develop inlet configurations and inlet flow conditions in order to improve containment of the inner-jet gas for application to the open-cycle gaseous-core nuclear rockets and to improve film cooling flow characteristics for application to closed-cycle nuclear light bulb rockets. The results from these tests indicate that the large eddies, characteristic of the interface between coaxial flows, could be essentially eliminated for flows in short chambers. This was done by decreasing the velocity gradient between the two streams at the coaxial-flow inlet so that any distrubances in the system would be convected from the chamber before developing into large waves or eddies. The best apparent inner-jet gas containment obtained with a modified inlet configuration in the short chamber was better than was obtained from previous tests. Tests with the centerbody and 30-in.-length configuration indicated that the disturbances from both the inlet and the exhaust systems need to be damped to prevent noticeable waves from forming in the chamber and developing into eddies. Author

N70-12233*# United Aircraft Corp., East Hartford, Conn. Research Labs.

EXPERIMENTAL INVESTIGATIONS OF HEAVY-GAS CONTAINMENT IN r-f HEATED AND UNHEATED TWO-COMPONENT VORTEXES

Arthur E. Mensing and Jerome F. Jaminet Sep. 1969 81 p refs

(Contract NASw-847)

(NASA-CR-107047; H-910091-20) Avail: CFSTI CSCL 20D

Experimental investigations were conducted in which the amount of heavy gas contained in light-gas vortexes was measured for both heated and unheated (isothermal) vortex flows. In the vortex flows with heat addition, power was added to the flow by r-f induction heating of the gas within the vortex chamber. The light gas, argon, was injected in a tangential direction either from the end walls or from the peripheral wall of the vortex chamber. The vortex flow rates, plasma diameter, and power addition were such as to provide a radial gradient of temperature of approximately 50,000 deg K in. near the outer edge of the plasma. Xenon was employed as the heavy gas and was injected into the vortex at several different locations. Spectroscopic techniques were used to determine both the temperature distribution and the xenon partial pressures within the plasma. Tests conducted with unheated vortex flows employed a vortex tube much larger than, but geometrically similar to, the vortex tube used in the heated tests. Air was used as the light gas and mixtures of iodine with helium, nitrogen or sulfur hexafluoride were used as heavy gases. Several different heavy- and light-gas injection configurations were used, and the weight flow rates of both the heavy and light gases were varied. The volume-averaged partial pressures of the heavy gas within the vortexes were determined, as were the radial distributions of the heavy-gas partial pressure. Author

N70-12249# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genèse (Belgium).

TURBULENT FLOW SEPARATION AHEAD OF FORWARD FACING STEPS IN SUPERSONIC TWO-DIMENSIONAL AND AXISYMMETRIC FLOWS

H. T. Uebelhack Jul. 1969 44 p refs

(VKI-TN-54) Avail: CFSTI

Pressure distributions in the separated flow region ahead of forward facing steps and on the step face in supersonic turbulent flows obtained at the von Karman Institute are compared with those found by previous investigators. The following geometries were investigated: flat plate step models, cone-cylinder-step models and axisymmetric internal flow models. Parameters such as step

height, unit Reynolds number and Mach number were compared. It was intended, in particular, to relate the axisymmetric results to existing two-dimensional data. A general law relating the variation of the step pressure integral with Mach number was found by analyzing pressure distribution on the step face. The influence of flow inclination, Mach number variation and three-dimensional effects on the characteristic pressures were discussed. The flow has been visualized by schlieren and shadow photographs and by the oil flow technique. Author (ESRO)

N70-12264# Commissariat à l'Energie Atomique, Saclay (France). Departement de Biologie.
FREE DIFFUSION OF TRANSLATION OF MACROMOLECULES IN SOLUTION WITH THE RAYLEIGH INTERFEROMETER
[DIFFUSION LIBRE DE TRANSLATION DES MACROMOLECULES EN SOLUTION PAR INTERFEROMETRIE DE RAYLEIGH]
Jean J. Leger Aug. 1969 68 p refs In FRENCH; ENGLISH summary
(CEA-R-3833) Avail: CFSTI

The aim of this study is to develop a rapid and accurate measurement of the free diffusion coefficient of translation of macromolecules in solution with the Rayleigh interferometer. After having explained the choice of a diffusion cell with laminar lateral flow and explained the principle of the Rayleigh interferometer a semi-automatic technique of free diffusion is then introduced. Solutions are proposed for systems composed of two or three components, such as biopolymers. The possible treatment of recorded experimental data by means of electronic computer is outlined. Author (ESRO)

N70-12273# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF TURBULENCE IN THE FLOW OF A VISCOUS FLUID
V. B. Letberskii 30 Jan. 1969 12 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 4, 1967 p 97–100
(AD-693441; FTD-HT-23-766-68) Avail: CFSTI CSCL 20/4

For the case of a structurally-viscous liquid, defined as a liquid in which the physical parameters do not depend on the time, the onset of a transient mode corresponds to a critical value of the resistance coefficient. Whereas it was proposed that the same criterion can apply to a Newtonian and non-Newtonian liquid, it is shown that no single criterion can be the same for the two types of liquids. A criterion based on the resistance coefficient is shown to be related to the Reynolds number in the case of a structurally-viscous liquid, and calculations of this criterion are presented for the case of a round tube, a flat slit, and an annular gap. It is shown that when the resistance coefficient is plotted against the Reynolds number, the onset of turbulence is characterized by a kink on the plot. The results of the calculations are found to be in agreement with published experimental data. Author (TAB)

N70-12297# Rensselaer Polytechnic Inst., Troy, N.Y.
HYPERSONIC FLOW STUDIES Final Report, Oct. 1963–Oct. 1968
H. S. Glick, R. Hofland, Jr., and H. B. Hollinger Wright-Patterson AFB, Ohio USAF May 1969 172 p refs
(Contract AF-33(615)-1080)
(AD-692743; ARL-69-0079) Avail: CFSTI CSCL 20/4

An experimental study of low-density hypersonic flow over a slender cone was conducted using air and helium as the test gases. The test flows spanned a range of free-stream Mach numbers from 12 to 24 in air, and from 36 to 80 in helium the range of Reynolds numbers extended from 200 to 100,000. A fundamental theoretical approach was sought to obtain guiding principles which will permit a unified determination of the equations of flux and equilibrium in fluid mechanics. The present approach is based on the "principle of recent equilibrium" and was applied to several simple situations, e.g., a collision less gas expanding into a evacuated tube. The interaction of thermal-energy gas particles with a solid surface was analyzed using a simple model. Statistical methods were applied to the model to determine the velocity distribution function of reflected particles in terms of the parameters of the problem. Author (TAB)

N70-12306# Grenoble Univ. (France). Faculté des Sciences.
CONTRIBUTION TO THE STUDY OF BOUNDARY LAYER TRANSITION: EFFECT OF WALL SUCTION [CONTRIBUTION A L'ETUDE DE LA TRANSITION EN COUCHE LIMITE: EFFET DE L'ASPIRATION PARIETALE]
Georges Lespinard (Ph.D. Thesis) Dec. 1968 226 p refs In FRENCH
Avail: CFSTI

The stabilizing influence of wall suction, which is well established for small perturbations, at all stages of the transition, is discussed. A method providing an effective means of varying the stability of the transition has been utilized and a mathematical model for laminar boundary layer has been developed. Details are given of the experimental design using a low turbulence wind tunnel and a multichannel ionized anemometer. Results of measurements in permanent boundary layers, and of the effect of suction at different rates are presented. ESRO

N70-12313# Lockheed Missiles and Space Co., Palo Alto, Calif.
DESTRUCTION OF GRAPHITE IN A LOW-TEMPERATURE AIR PLASMA FLOW
A. B. Karasev et al [1968] 6 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii (Minsk), v. 11, no. 3, 1969 p 403–407
Presented to the 2nd All-Union Conf. on Low-Temp. Plasma Phys., Minsk, 18-20 Nov. 1968
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Hypersonic gas flow around a sphere was examined using differential equations to estimate the influence of destruction products, which drop into the flow from the body surface, on the heat exchange characteristics. The problem was solved for a viscous shock layer model. The analysis was performed in two stages: (1) Computations were carried out for a wide range of temperatures and pressures, assuming that the optical properties of the free stream and gaseous destruction products were independent. (2) The low temperature air plasma flow around a sphere was solved taking into account the actual dependence of the flow components spectral characteristics on the wavelength. The results obtained were confirmed qualitatively by experiments on nonradiating flow around cones. J.A.M.

N70-12339# Queen Mary Coll., London (England).
APPROXIMATE SOLUTIONS OF THE THREE-DIMENSIONAL LAMINAR BOUNDARY LAYER MOMENTUM INTEGRAL EQUATIONS
P. D. Smith (Ph.D. Thesis, Nov. 1965) and A. D. Young 1968 34 p refs Supersedes ARC-29407; N69-11507
(ARC-CP-1064; ARC-29407) Avail: HMSO 8s; BIS $1.60

Six methods for the approximate solution of the three-dimensional laminar boundary layer momentum integral equations are presented and compared with three known exact solutions. These methods all involve the Pohlhausen technique of specifying velocity profiles in terms of one or two unknowns and substituting these expressions for the profiles into the two momentum integral equations to render them determinate. Comparison of these methods with the exact solutions shows that the assumption of small cross-flow velocity in the boundary layer is generally adequate in cases involving favourable pressure gradients but introduces significant errors in cases involving adverse pressure gradients. In cases of moderate adverse pressure gradient the accuracy of the approximate solution may be improved to some

extent by the adoption of an extension of the Luxton-Young technique. However, for large adverse gradients adequate accuracy may only be obtained by including the cross-flow terms in the momentum integral equations, and the method described here is then shown to lead to very satisfactory results in all the cases examined. It appears that provided the maximum value of the angle β between the limiting and external streamlines is less than about 10° the small cross-flow assumption is of adequate accuracy for most engineering purposes. Author (ESRO)

N70-12382# Cambridge Univ. (England). Dept. of Engineering.
THE EFFECTS OF CURVATURE ON THE TURBULENT BOUNDARY LAYER
V. C. Patel Aeron. Res. Council 1969 33 p refs Supersedes ARC-30427
(ARC-R/M-3599; ARC-30427) Copyright. Avail: CFSTI; HMSO 17s 6d; BIS $3.50

Preliminary measurements in the turbulent boundary layers on a circular cylinder and the convex wall of a 90 degree curved duct are described. The results indicate quite significant effects of longitudinal surface curvature on the development of the boundary layer. In particular it is shown that (a) curvature has a marked influence on the velocity profiles, (b) the usual momentum integral equation for flat surface flow breaks down in the presence of large static pressure variations across the boundary layer, and (c) none of the existing boundary-layer calculation methods adequately predicts the development of the shape factor. A more general momentum integral equation has been derived from first principles. This gives reasonable agreement with the experimental development of the momentum thickness. Author (ESRO)

N70-12371# McDonnell-Douglas Astronautics Co., Santa Monica, Calif. Western Div.
STRONG BLOWING INTO LAMINAR VISCOUS FLOWS AROUND TWO-DIMENSIONAL AND AXISYMMETRIC SUPERSONIC BODIES
G. R. Inger and G. A. Gaitatzes Nov. 1969 66 p refs
(MDC-G1227) Avail: CFSTI

A generalized boundary layer model of laminar flow around high speed slender bodies with large surface mass transfer, which takes into account the combined effects of viscosity, compressibility, lateral pressure gradients, three dimensional transverse curvature and viscous inviscid interaction, is investigated. An integral method solution of this model is obtained and applied to the case of uniform massive blowing on supersonic semi-infinite wedges and cones where the dividing streamline becomes straight. Their cold wall hypersonic similitude is thereby extended to axisymmetric flows; moreover, the present study shows that the similitude continues to apply with good approximation under strong blowing conditions. Numerical results are presented for the blowing effect on the streamline pattern, induced pressure field and blown gas layer thickness, with emphasis on a parametric study of the important effects of transverse curvature, lateral pressure gradients, velocity profile input and choice of inviscid flow model over a wide range of flight Mach number wall temperature conditions. Author

N70-12404# Texas Univ., Austin. Applied Research Labs.
TURBULENT BOUNDARY LAYER SEPARATION AHEAD OF CYLINDRICAL PROTUBERANCES IN SUPERSONIC FLOW
James Harvel Mashburn Aug. 1969 55 p refs Prepared in cooperation with Johns Hopkins Univ.
(AD-690947; ARL-TR-69-17) Avail: CFSTI CSCL 20/4

The paper surveys the current state of analytical attempts at a theory of turbulence. The formulation of the problem in terms of moments is discussed. The difficulty posed by the closure problem is examined in detail using the quasi-normal approximation as an example. The notion of dynamical relaxation by nonlinear scrambling leads to the introduction of eddy relaxation times and the direct-interaction approximation. The properties of the direct-interaction approximation are indicated. Finally, a comparison is made between numerical solution of the equations of turbulence theory and direct numerical simulation of the Navier-Stokes equations. Author (TAB)

N70-12406# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.
ANALYTICAL THEORIES OF TURBULENCE
Steven A. Orszag Aug. 1969 54 p refs Submitted for Publ.
(AD-693194; D1-82-0681) Avail: CFSTI CSCL 20/4

The paper surveys the current state of analytical attempts at a theory of turbulence. The formulation of the problem in terms of moments is discussed. The difficulty posed by the closure problem is examined in detail using the quasi-normal approximation as an example. The notion of dynamical relaxation by nonlinear scrambling leads to the introduction of eddy relaxation times and the direct-interaction approximation. The properties of the direct-interaction approximation are indicated. Finally, a comparison is made between numerical solution of the equations of turbulence theory and direct numerical simulation of the Navier- Stokes equations. Author (TAB)

N70-12441# Lockheed Missiles and Space Co., Palo Alto, Calif.
EXPLANATION OF THE TOM'S EFFECT OF ANISOTROPY IN THE VISCOSITY OF A SOLUTION
G. F. Kobets 21 Oct. 1968 7 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekh. Fiz., no. 1, 1969 p 107–111
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Qualitative computations based on a hypothesis which resolves two pecularities of solution flow are presented and compared to experimental values in order to explain the Toms effect. The hypothesis states that because of the large velocity gradient in the viscous sublayer and the transition layer, the elongated particles are oriented along the stream, thereby quenching the transverse velocity pulsations. The results is a diminution of turbulent friction. Experimentally established relations for the quasi-stationary thickness of the viscous sublayer and the distribution of the average velocity in Newtonian fluid flow are used to compute the Toms effect. The final quantitative expression correctly reflects the regularities of turbulent flow in chain macromolecule solutions, and provides quantities which agree with experimental results. It is concluded that the dependence of the Toms effect on solution concentration should be studied more because the magnitude grows as the concentration increases. M.H.E.

N70-12495*# Mississippi State Univ., State College. Engineering and Industrial Research Station.
RESEARCH STUDY FOR DETERMINATION OF LIQUID SURFACE PROFILE IN AN CRYOGENIC TANK DURING GAS INJECTION Annual Report, 18 Jun. 1967 – 17 Jun. 1968
William D. Mc Cain, Jr., James T. Smith, and Thomas J. Rice 17 Jun. 1968 84 p
(Contract NAS8-11334)
(NASA-CR-102360; AR-4) Avail: CFSTI CSCL 20D

The determination of entrainment for an entrapped liquid as a function of time duration of air flow, air flow rate, viscosity, and fraction of test configuration volume occupied initially by the fluid was studied in three test configurations. Entrainment is defined as liquid removal by an air stream either as liquid droplets, or as a flowing stream. Results of the entrainment experiments for each configuration are tabulated, and it is concluded that: (1) The roughness of the vertical exit pipe has negligible effect on the entrainment of a liquid by an air stream. (2) The position of entry point of the air makes little difference in removal of the liquid. F.O.S.

N70-12589# Case Western Univ., Cleveland, Ohio. Div. of Fluid, Thermal and Aerospace Sciences.
BOUNDARY LAYER INDUCED PRESSURES ON A FLAT

PLATE IN UNSTEADY HYPERSONIC FLIGHT
Tse-Fou Zien and Eli Reshotko May 1969 29 p refs
(Grant AF-AFOSR-1581-68)
(AD-693233; FTAS-TR-69-43; AFOSR-69-1229TR) Avail: CFSTI CSCL 20/4

A procedure was developed for the calculation of unsteady hypersonic viscous interaction pressures. The procedure is based on the idea of the tangent wedge approximation and is valid for weak interactions. Examples were worked out, using this procedure to illustrate the weak pressure interactions in unsteady hypersonic flow. The results presented are based on the available solutions for boundary layer flows, without interactions, over a flat plate which undergoes unsteady motion in its own plane. Thus the case of small deviations from steady flows and the initial stage case (or a doubly infinite plate case) were considered for both insulated and isothermal plates. Induced pressures, to first approximation, are presented and the viscous interaction parameters are brought out.
Author (TAB)

N70-12680# Lockheed Missiles and Space Co., Palo Alto, Calif.
MIXING PROCESSES IN AN AXISYMMETRIC JET IN A TRANSVERSE FLOW
V. Gendrikson 1969 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz., Mat. (USSR), v. 17, no. 4, 1968 p 449–457
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

An experimental jet was studied and velocity fields were measured at various cross-sections for three velocity relations in an attempt to compute jet damping. Main jet damping in a transverse flow demonstrated the most significant effects in the active part of a jet having measurable velocity gradients. Integral relations of the conservation of impulse, excess enthalpy, and thermal concentration were used to compute the damping of the axial velocity, temperature, and concentration of a free jet, or of a jet developed in a counter flow. This computation included effects of the presence of a variable pressure force field and the curvilinearity of the flow. Comparisons between computed and experimental values are presented in graphs.
M.H.E.

N70-12899# Naples Univ. (Italy). Istituto di Aerodinamica.
NON-LINEAR NON EQUILIBRIUM FLOWS Annual Scientific Report, 15 Nov. 1967 - 14 Nov. 1968
L. G. Napolitano Jun. 1969 78 p refs
(Contract F61052-68-C-0035)
(AD-693334; AFOSR-69-2050TR) Avail: CFSTI CSCL 20/4

The first part of the report deals with the non-linear acoustics for singly reacting media. The non-linear wave equation is derived to within a small perturbation approximation and its physical implications are discussed. The type and nature of additional simplifications which can be obtained under particular hypothesis on the equilibrium thermodynamic properties of the medium and/or the kinetics of the process are analized and relevant analogies are established and commented upon. In the second part the effects of the multiplicity of principal relaxation frequencies are considered. By means of the spectral decomposition of the relaxation matrix the following result is proved: the features of any linearized non-equilibrium flow field do not depend on the number of independent rate processes taking place in the gas mixture but, rather, on the number of distinct principal relaxation frequencies. The analogies following as a corollary of this statement are pointed out and discussed.
Author (TAB)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N70-11463# National Observatory of Athens (Greece). Seismological Inst.
AFTERSHOCK SEQUENCES AND CRUSTAL STRUCTURE IN THE REGION OF GREECE Final Report
A. B. Galanopoulos and B. C. Papazachos Jun. 1969 24 p refs
(Contract AF 61(052)-803)
(AD-693323; AFOSR-69-2198TR) Avail: CFSTI CSCL 17/10

The report contains: Installation of six new stations in appropriate sites in the region of Greece. Study of the distribution in time and magnitude, the strain release characteristics and other properties of the aftershock and foreshock sequences (1) of all shocks of M 5.9 which have occurred in the region of Greece between 1911 and 1968, and (2) of smaller main shocks occurred between 1957 and 1967. Determination of some basic crustal and upper mantle properties in the region of Greece by using travel times of body waves and dispersion properties of surface waves. Investigation of the relation between the water loading of two artificial lakes in the region of Greece and the earthquake activity in foreshocks or swarm of shocks triggered by this anomalous change of fluid pressure. Investigation of seismicity and problems of geotectonics in the region of Greece in connection with results derived from the investigation of crustal structure and aftershock sequences.
Author (TAB)

N70-11478# California Univ., Berkeley. Hydraulic Engineering Lab.
COMPARISON OF WIND WAVE AND UNIFORM WAVE EFFECTS ON A BEACH
Peter Truman Krasi Aug. 1969 47 p refs
(Contract DACW72-68-C-0016)
(AD-693262; HEL-1-13) Avail: CFSTI CSCL 8/6

A series of two dimensional experiments were made in a wave channel to compare the nearshore beach profiles formed by wind generated waves with the profiles formed by periodic machine-generated waves. Although equilibrium was easily obtained in the case of uniform periodic wave exposure, it was not possible to achieve equilibrium when the beach was exposed to wind waves. Particles of neutral buoyancy and dyes indicated that the basic current systems differed in the offshore zone for the two cases. Arguments are presented to show that no theoretical equilibrium beach profile exists for the case of a beach exposed to locally generated wind waves.
Author (TAB)

N70-11486# Army Foreign Science and Technology Center, Washington, D.C.
SWAMPY FOREST ZONE TERRAIN
Ye. A. Galkina 9 Aug. 1969 18 p refs Transl. into ENGLISH from Geograph. Reference Book, v. 7, 1955 p 75–84
(AD-692654; FSTC-HT-23-736-69) Avail: CFSTI CSCL 8/8

The author shows the necessity for the use of aerial photography in the study of swamp terrain. He then discusses some of the general features of swamp terrain as it appears in aerial photographs of different scale. The article is taxonomic and classificatory in nature. Ten basic types of swamp terrain are discerned, the chief criteria are size and course of development. The author concludes with a favorable appraisal of the advantages and potentialities of the use of aerial photography for the study of swamp terrain.
Author (TAB)

N70-11521# Naval Underwater Sound Lab., New London, Conn. Ocean Sciences Div.
PHYSICAL OCEANOGRAPHY OF BLOCK ISLAND SOUND
Robert G. Williams 1 Jul. 1969 61 p refs
(AD-693443; USL-966) Avail: CFSTI CSCL 8/10

Block Island Sound (BIS), which has a mean depth of about 40 meters, has features common to both a tidal estuary and the offshore waters of the Continental Shelf. It has access to the sea through two broad channels and access to Long Island Sound through two narrow channels. In winter, the water is well mixed and

of low temperature (1C - 3C). In summer, a thermocline develops, such that surface temperature is 20C, while bottom temperature may be as low as 10C. Surface salinity is about 29.00 salinity near The Race and almost 33.00 salinity near Block Island. Relatively large horizontal gradients of temperature and salinity are possible in BIS. Typical winter and summer sound-velocity profiles are presented, as well as information on density, stability, optical transparency, and currents. The currents are shown to be predominantly tidal with the semidiurnal component the most important. Current speeds approach 5 knots in The Race and decrease to 0.5 knot near Block Island. The report concludes with recommendations for future research and the proposal of a measuring program that uses moored oceanographic buoys, or towers, ships, and aircraft. Author (TAB)

N70-11528# Army Foreign Science and Technology Center, Washington, D.C.
DYNAMICS OF ICE FORMATION
Ye. A. Rumyantsev 9 Aug. 1969 28 p refs Transl. into ENGLISH from Borba s Naledami na Zheleznykhi Avtomob. Dorogakh Transport (Moscow), no. 7, 1966 p 84-97
(AD-692653; FSTC-HT-23-683-68) Avail: CFSTI CSCL 8/12

In view of the hazards posed to railroads and highways by the formation of ice in the permafrost areas of the USSR, the author describes the dynamics of the icing process and the effect of various factors such as weather, climate, terrain, and man-made structures on the intensity of the ice-forming process. The study is limited to two types of ice formations, namely ground ice formations and key ice formations. Also described are certain phenomena associated with the development of the ice process, the most important of which is suffusion of the soil. The effects of seasonal freezing of the permafrost on the development of ice are also considered. Author (TAB)

N70-11529# Army Foreign Science and Technology Center, Washington, D.C.
INTERPRETATION OF GROUND WATER OF TYPICAL LANDSCAPES IN THE CASPIAN LOWLAND ON AERIAL PHOTOGRAPHS
S. V. Vinogradov et al 8 Sep. 1969 84 p refs Transl. into ENGLISH from the publ. "Primenenie Aerometodov Dlya Izucheniya Gruntovykh Vod" Moscow, Izd. AN SSSR, 1962 p 34-68
(AD-693148; FSTC-HT-23-530-68) Avail: CFSTI CSCL 8/8

In this paper it is shown that by performing a certain amount of work in key sectors in semidesert regions it is possible to use aerial photographs to interpret the nature of the upper water-bearing horizon of ground water and the conditions under which ground water is found to depths as great as 10-12 m, that is, to a depth where the presence of the ground water table still has physicogeographic effects. The fundamental method for the hydrogeological interpretation of aerial photographs is the landscape method. This method takes into account the entire complex of hydroindicators: vegetation, relief, soils and ground types, as well as the patterns of their spatial distribution. Author (TAB)

N70-11557# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 208 17 Jul. 1969 p 16-28 refs (See N70-11554 02-30)
Avail: CFSTI

News articles and summaries and abstracts of journal articles are presented. The use of satellites for oceanographic research, a seslab, and problems in underwater photography are briefly described. A network of ships with hydrometeorological stations, a geological prospecting ship, and a university research ship are mentioned. Charts of the sea bottom near the Black Sea coast, the depth of the active layer in the North Atlantic, and the hydrodynamic features of surge-induced phenomena in the Gulf of Taganrog are reported. The heat balance equation for the Norwegian Sea and temperature anomalies in the Norwegian and Greenland Seas are determined. Mathematical expressions are given for the transfer of wind energy to waves, the vertical component of a pure drift current, turbulent diffusion in the sea, and tidal level fluctuations in a three dimensional current. An 11-year temperature cycle in the Gulf Stream is related to the solar activity and experiments for measuring sea temperature fluctuations are described. The distribution of heterotrophic bacteria in the Indian Ocean, a ship rescue service, and an oceanographic conference are mentioned. N.E.N.

N70-11558# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 208 17 Jul. 1969 p 29-40 refs (See N70-11554 02-30)
Avail: CFSTI

Summaries of news and journal articles are presented. The propagation velocity of longitudinal seismic waves along the Moho, deficit of longitudinal wave velocity in slightly seismic zones, and numerical determination of crustal parameters are briefly discussed. Magnetic observations near Alma-Ata and families of geomagnetic storms, 1957-1964, are described. Spectral characteristics of Pi2 pulsations and waveguide propagation of PC1 pulsations were determined. Thermal aerial survey of Kamchatka volcanoes, reflected surface waves accompanying earthquakes, and dispersion of surface waves in the upper crust of Central Asia were studied. The distribution of seismic waves from microseismologging data, fault dislocations in the Kuril zone, and the elastic characteristics of rocks in mines are also described. Latitude determinations, seismotectonic map of Europe, Dushanbe earthquakes, remote monitoring of volcano temperatures, explosion-detecting antenna, and Groznyy earthquake are mentioned. N.E.N.

N70-11559# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, no. 208 17 Jul. 1969 p 41-51 refs (See N70-11554 02-30)
Avail: CFSTI

Abstracts of journal articles and excerpts of news articles are presented. The structure of plasma flow in the magnetosphere, molecular ion concentrations at 200-2100 km, and electron and gamma quanta intensities at balloon altitudes are described. Positive and negative conjugation of F2 layer, vertical drift of ionization and electron density in the F region, and short period changes in the altitudes of ionospheric reflections are discussed. Soviet satellite observations, self-induced spacecraft oscillations, and axisymmetrical satellite stabilization are reported. Anomalous absorption in the auroral zone and determining the directions in space triangulation are also described. International laws on space resources, a review of aerospace science and technology, and the launchings of Cosmos 285, Cosmos 286, and Cosmos 287 are mentioned. N.E.N.

N70-11562# Army Foreign Science and Technology Center, Washington, D.C.
EVALUATION OF THE COMPRESSIVE STRENGTH OF ICE UNDER SHORT-TERM RAPIDLY INCREASING LOAD
K. N. Korzhavin et al Aug. 1969 19 p refs Transl. into ENGLISH from Materialy 8 Vsesoyuznaya Mezhduved. Soveshch. po Geokriologii Merzlotovedemiyu, v. 5, 1966 p 61-72
(AD-693227; FSTC-HT-23-188-68) Avail: CFSTI CSCL 8/12

A mathematical analysis of the strength of ice, as a component of frozen rock or soil. Strengths are differentiated for compressive and shear loading at various rates over various periods of time. Author (TAB)

N70-11583# Bergen Univ. (Norway). Seismological Observatory.
SPECTRAL ANALYSIS AND STATISTICAL PROPERTIES OF MICROSEISMS AT NORSAR

Eivind Rygg, Hilmar Bungum, and Leif Bruland Mar. 1969 46 p refs
(Contract F61052-68-C-0019)
(AD-693329; SR-1; AFOSR-69-2124-TR) Avail: CFSTI CSCL 17/10

Below 0.7 cps the seismic noise recorded by the short period seismometers at NORSAR (Norwegian Seismic Array) is generally dominated by sources in the Atlantic and on the Norwegian coast. When strong low pressure areas are observed outside the coast, the noise has a dominating direction of propagation from the low, and a velocity generally in the range 3-4 km/sec. A low in the Baltic Sea has been found to contribute more to the noise at higher frequencies than the Atlantic sources, its influence extending to lower frequencies as the low moves towards the array. Strong local winds have been found to have little influence in the microseismic range. The noise coherence between sensors is some times much higher in the direction of dominating noise propagation than in other directions. This seems to happen when the noise level is high and when the lows are close to the coast. From the distribution of the sample variances it is assumed that the noise is stationary within half-hour intervals used in the noise analysis. The noise predictability has a maximum during periods with high microseismic activity. Author (TAB)

N70-11608# Bergen Univ. (Norway). Seismological Observatory.
A Pn TIME-TERM SURVEY IN SOUTHEASTERN NORWAY
Markvard A. Sellevoll and Eirik Sundvor 1 Mar. 1969 20 p refs
(Contract F61052-68-C-0019)
(AD-692892; SR-2; AFOSR-69-2088-TR) Avail: CFSTI CSCL 17/10

Chemical explosions with charges ranging from 510 kg to 2200 kg were used in this Pn time-term survey in thhe southeastern Norway. The calculated Pn time-terms are indicating a Moho-depth of about 33-35 km in the northern part of the Oslo Graben system. The Moho-discontinuity beneath the Oslo Graben is elevated compared with the regions on its east and west sides. Author (TAB)

N70-11609# Army Foreign Science and Technology Center, Washington, D.C.
INTERPRETATION OF DIFFERENT TYPES OF TUNDRA FROM AERIAL PHOTOGRAPHS AND THEIR AEROVISUAL DESCRIPTION ON THE BASIS OF FROST JOINTING
V. N. Andreev 1969 32 p refs Transl. into ENGLISH from Geofiz. Sb., Akad. Nauk Ukr. SSR, Inst. Geofiz. (Kiev), v. 7, 1955 p 103-120
(AD-692646; FSTC-HT-23-316-68) Avail: CFSTI CSCL 8/8

Frost fissuring of the ground surface exerts a considerable influence on the development of vegetation in three groups of plant associations in the tundra zone: (a) in the group of associations of polygonal swamps developing in areas recently emerging from beneath the level of sea, lake or river water; (b) in the group of peaty tundras and tundra peat bogs associated with the interfluves and (c) in the group of arctic deserts and various lichen tundras developing on mineral ground. In each group the frost fissuring has its distinguishing characteristics which create a singular surface pattern. The latter can be successfully used in the interpretation of each group of associations on aerial photographs and for their description by aerovisual observations. Polygonal swamps, under the influence of development of frost fissuring, peat accumulation and melting of permafrost, undergo several stages of development (arctic, ridged, ridged-lake, hummocky-meadow and ridged-polygonal-meadow swamps), each of which has its distinguishing characteristics, created as a result of development of the frost fissure network. The defined types can be distinguished by aerial methods on the basis of these peculiarities. In peaty and tundra peat bogs, under the influence of frost fissuring, processes of drawing out and decomposition of peat occur. As a result, the plant associations and microrelief forms change, affording the possibility for interpreting individual types. Author (TAB)

N70-11644# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 211 3 Sep. 1969 p 17-24 refs (See N70-11641 02-30)
Avail: CFSTI

An overview is presented of oceanographic research in the southern latitudes, and the discovery of an abyssal depression near the South Orkneys is noted. Abstracted data are provided on the ice regime in the Weddell Sea; vertical water circulation in the Arctic basin; heat flux measurements made by separately determining the geothermal gradient and the heat conductivity of the bottom layer of sedimentary deposits in the Arctic Ocean; physicomechanical properties of bottom deposits; the shortcomings of the electromagnetic current recorder; and the formation of transverse structures in the central part of the North Atlantic Ocean. M.G.J.

N70-11645# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 211 3 Sep. 1969 p 25-38 refs (See N70-11641 02-30)
Avail: CFSTI

Abstracts are presented on studies dealing with the deep sounding in the southeastern Baykal region; differences in physical processes at the foci of strong and weak earthquakes; velocities of longitudinal waves in sedimentary rocks; the velocity profile of the earth's crust in the central Ukraine; deep soundings using magnetic storms; regional magnetic anomalies in the Caucasus and Central Asia; isostasy of the Lake Baykal depression; use of a model in determining the characteristics of seismic waves; testing of borehole polarization transducers in ultrasonic logging; the influence of the earth's sphericity in determining the resistivity of deep layers; waveguides in the earth's mantle; and the possibility of determining the azimuth to the epicenter from three close stations. News items pertain to crustal studies in Georgian S.S.R. seismic data recording, and borehole drillings. M.G.J.

N70-11674# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 209, 210 13 Aug. 1969 p 19-33 refs (See N70-11671 02-30)
Avail: CFSTI

Abstracts of Soviet news and journal articles are presented. The topics cover the following areas of investigations: surface wave measurements, deep and surface currents; continental shelf; tides and turbulence; temperature measurements; marine biology; ocean bottom deposits and formation; research journeys; mineral resources on ocean bottoms; prospecting for petroleum; and cooperation with Japan, France, and India. N.E.N.

N70-11675# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 209, 13 Aug. 1969 p 34-36 refs (See N70-11671 02-30)
Avail: CFSTI

Reports on the earth's structure, earthquakes, and tsunami warning center are summarized. The contributions and limitations of applying paleomagnetic data to the problem of the continental drift are briefly discussed. A conference on the relationship between surface structures of the earth's crust and deep layers is reviewed. A hydrophysical observatory on Shikotan Island was built for studying and detecting tsunamis. Records of Caucasian seismic stations are considered to indicate that refracted and reflected surface waves are formed during Tien Shan earthquakes. N.E.N.

N70-11677# New York Univ., N.Y. Courant Inst. of Mathematical Sciences.
A VARIATIONAL PRINCIPLE FOR PERIODIC WAVES OF INFINITE DEPTH
Ellen R. Gottlieb Sep. 1969 84 p refs
(Contract Nonr-285(46))
(AD-693634; IMM-377) Avail: CFSTI CSCL 8/3

The paper deals with periodic waves on an ocean of infinite depth. The flow is assumed to be two-dimensional, incompressible, steady, and irrotational. The impossibility of the existence of an asymmetric wave is proved. This is accomplished through an application of Steiner symmetrization. Also discussed is the shape of possible periodic waves. Using the calculus of variations, an extremal problem is set up involving the kinetic energy, an area integral, and the potential energy. For waves of small amplitude the kinetic energy is shown to be a minimum if one fixes the area and the potential energy. This is accomplished by showing the first variation to be zero and the second variation to be positive. Since the kinetic energy is closely related to the Dirichlet integral, this is a generalization of the Dirichlet principle. This result is applicable in showing the existence of periodic surface waves. Author (TAB)

N70-11713 General Dynamics/Convair, San Diego, Calif.
OCEAN DATA STATION ALPHA SENSOR SYSTEM DESCRIPTION NORTH PACIFIC STUDY CONFIGURATION
David L. Berquist Jul. 1969 132 p
(Contract Nonr-3062(00))
(AD-693544; GDC-AAX-69-004) Avail: CFSTI CSCL 8/10

The primary scientific function of Buoy ALPHA during the North Pacific Study is to gather meteorological and oceanographic data. The meteorological data requirements for this experiment are wind velocity and air temperature at 5, 10, and 15 meters above sea level, absolute moisture content, rainfall, radiation, and barometric pressure. Oceanographic data requirements include surface roughness, current velocity, seawater temperature, and air/sea interface temperatures. Underwater measurements of temperature, depth, and conductivity are made at ten positions along the mooring line to a depth of 500 meters. Engineering data requirements comprise the remainder of the buoys sensor complement. The engineering measurements provide information which is used to establish hull integrity and proper operation of maritime safety equipment. Engineering data are also needed to monitor performance of the Energy Conversion System, Data Acquisition and Control System, and Telemetry and Command Systems. Author (TAB)

N70-11718# Army Foreign Science and Technology Center, Washington, D.C.
USING AERIAL PHOTOGRAPHY IN DIFFERENT SPECTRUM INTERVALS TO STUDY VEGETATION AND SOILS
A. I. Vinofradova 1969 29 p refs Transl. into ENGLISH from Geogr. Sb. (USSR), v. 5, 1955 p 59–74
(AD-693225; FSTC-HT-23-309-70) Avail: CFSTI CSCL 8/6

In recent years, in our nation there has been a significant increase in the number of specialists in different areas who make extensive use of aerial photography in their work. Along with broadening the sphere for using aerial methods, we can also clearly note a general move toward greater specificness in the technical and natural conditions of aerial photography. Various departments have ceased to be satisfied with the available finished materials from an aerial photographic survey which have been obtained for different purposes. They are working out their own requirements upon the conditions of aerial photography in terms of the survey scale, the type of film and the light filter, the focal length of the camera and the type of camera, as well as in terms of the season of the photographing, and are conducting the corresponding aerial photographic surveys. Author (TAB)

N70-11720# Army Foreign Science and Technology Center, Washington, D.C.
AERIAL PHOTOGRAPHY AND MAPPING OF THE SIBERIAN FOREST
G. P. Motovilov 30 Jul. 1969 190 p refs Transl. into ENGLISH from the Russian
(AD-693226; FSTC-HT-23-46-68) Avail: CFSTI CSCL 8/2

A number of theoretical and methodical problems of aerial survey and cartography are discussed in this book and a new method of determining the seasonal conditions of aerial surveys by phenological maps is described. Author (TAB)

N70-11721# Army Foreign Science and Technology Center, Washington, D.C.
UTILIZATION OF AERIAL PHOTOGRAPHY FOR THE GEOGRAPHIC STUDY OF THE DESERTS OF CENTRAL ASIA
M. P. Petrov 8 Sep. 1969 20 p refs Transl. into ENGLISH from the Russian
(AD-693147; FSTC-HT-23-500-68) Avail: CFSTI CSCL 8/6

Aerial photographic work in the deserts of East Central Asia, in comparison with the deserts in West Central Asia, does not differ basically. The methods of Soviet scientists to utilize aerial photography in the geographic studies on the desert territories of the Soviet Union could successfully be used also in East Central Asia. It is necessary to disseminate widely these methods and achievements in order to introduce these into geographic studies of the tremendous desert territories of the Chinese Peoples Republic. Author (TAB)

N70-11722# Army Foreign Science and Technology Center, Washington, D.C.
STUDY OF THE SPECTRAL BRIGHTNESS OF SOME LANDSCAPE ELEMENTS FOR INTERPRETATION OF GROUND WATER ON AERIAL PHOTOGRAPHS
E. S. Artsybashev 26 Jun. 1969 43 p refs Transl. into ENGLISH from the Russian
(AD-692647; FSTC-HT-23-353-68) Avail: CFSTI CSCL 8/8

The report presents experience in the study of the spectral reflectivity of some landscape elements (primarily vegetation and soils) which are ground water indicators and describes the use of these data for the hydrogeological interpretation of aerial photographs. The studies were made during 1958-1960 in two geographical zones of the Soviet Union: desert (Turkmenia) and semi-desert (Caspian Lowland). The method for interpreting ground water described in this paper was checked by making similar studies in the forest zone of the northwestern regions of the USSR. The objects for spectral photometric studies in each geographical zone were those types of vegetation and soils which form the basic appearance of the landscape. Author (TAB)

N70-11727* # Stanford Research Inst., Menlo Park, Calif.
RESEARCH RELATED TO MEASUREMENTS OF ATOMIC SPECIES IN THE EARTH'S UPPER ATMOSPHERE
Bernard J. Wood and Bill R. Baker 1 Sep. 1969 11 p refs
(Contract NASr-49(30))
(NASA-CR-106805; QSR-9) Avail: CFSTI CSCL 04A

Oxygen atom reactions with solid surfaces were investigated to improve data interpretation of atomic oxygen composition reported by mass spectrometers in upper atmospheric flight. Interaction rates were observed with metal surfaces in a reaction vessel. Atom removal by recombination, as indicated by the steady, high ratio of mass 32/mass 16 measured by the OGO-F mass spectrometer at perigee, was confirmed by the experimentally determined behavior of gold. A precise correction for the atom removal term is suggested based on recombination coefficients derived from rate data to provide an absolute evaluation of the oxygen atom particle density being sampled. Similar corrections are recommended for the oxygen data from the Explorer 32 satellite. M.H.E.

N70-11728# Joint Publications Research Service, Washington, D.C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 206
4 Jun. 1969 93 p refs Transl. into ENGLISH from the Russian
(JPRS-48158) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1–19 refs (See N70-11729 02-30)
2. METEOROLOGY p 20–34 refs (See N70-11730 02-20)
3. OCEANOGRAPHY p 35–48 refs (See N70-11731 02-13)
4. TERRESTRIAL GEOPHYSICS p 49–62 refs (See N70-11732 02-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 63–86 refs (See N70-11733 02-13)
6. MISCELLANEOUS p 87–91 refs (See N70-11734 02-20)

N70-11731# Joint Publications Research Service, Washington, D.C.

OCEANOGRAPHY

In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 205 4 Jun. 1969 p 35–48 refs (See N70-11728 02-13)
Avail: CFSTI

Summaries of research reports and articles on ocean currents, temperature, surface interactions, and related studies are presented. Investigations of the Atlantic were made on the horizontal density of circulation, vertical heat flux, vertical component of convective current, and pressure and temperature interactions at the ocean–atmosphere interface. The structure of the rift zone of the Indian Ocean and the concentration and type of organic matter of floor rocks were determined, and deep seismic soundings were made. Surface water temperature was measured in the Black Sea, and rare earth elements were found in ferromanganese nodules along the Crimean shores. Surface currents in the Norwegian and Greenland Seas were calculated and data obtained from a sealab excursion are indicated. A mathematical discussion of tidal currents, and the diurnal variation of temperature at the atmosphere–ocean interface are described briefly. N.E.N.

N70-11732# Joint Publications Research Service, Washington, D.C.

TERRESTRIAL GEOPHYSICS

In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, no. 205 4 Jun. 1969 refs p 49–62 (See N70-11728 02-13)
Avail: CFSTI

Abstracts of articles on geomagnetism, geology, and seismology are presented. Palemagnetism, anomalies in the geomagnetic field, and seismic shock effects on the geomagnetic field are described, including the natural residual magnetization in tertiary and quaternary deposits and the paleomagnetic stability of rocks. The earth's upper mantle and crust, and seismic effects of explosions were studied. Magnetotelluric soundings, geothermal anomaly, and the packing density of atoms in rocks are reported. Discussions of magnetometer design, auxiliary equipment, and uses are also given. N.E.N.

N70-11733# Joint Publications Research Service, Washington, D.C.

UPPER ATMOSPHERE AND SPACE RESEARCH

In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 4 Jun. 1969 p 63–86 refs (See N70-11728 02-13)
Avail: CFSTI

Brief discussions are given on the Soviet space program activity, upper atmospheric soundings, and Venusian atmosphere studies. Satellite orbital perturbations, control, and observations, and lunar probe data on solar radiation hazards are described. Ionospheric inhomogeneities, sporadic E layer and vertical movements, zonal drift effects on F region ionization, sporadic E layer frequency characteristics, ionization in the polar ionosphere, and F 1 layer formation are discussed. Data are given on stony meteorites, origin of geomagnetism, twilight phenomena, and the relationship between geomagnetic pulsation and changes in the magnetospheric plasma density. Temperature and pressure measurements, and optical properties of the Venusian atmosphere are described, along with the greenhouse effect in it and a model based on Venera data. N.E.N.

N70-11768# Columbia Univ., Palisades, N.Y.

A COMPUTER SYSTEM FOR THE REDUCTION, STORAGE AND DISPLAY OF UNDERWAY DATA ACQUIRED AT SEA

Manik Talwani Aug. 1969 295 p refs
(Contract N00014-67-A-0108)
(AD-693293; TR-1) CSCL 8/10

A system of programs for the reduction and display of gravity, topographic, and magnetic data acquired underway at sea is described. Special attention is given to the problem of storage and acquisition of the data. Author (TAB)

N70-11797# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

A MODEL FOR THE SEMIANNUAL EFFECT APPEARING IN THE DRAG DATA OF SATELLITES IN ECCENTRIC ORBITS

Albert D. Anderson Oct. 1969 36 p refs
(LMSC-6-78-69-37) Avail: CFSTI

The interaction of selected eccentric-orbit satellites with density distributions for both hemispheres and every month is analyzed. It is shown that some satellites will exhibit a marked semiannual effect as a result of latitudinal density variations. A comparison of calculations from the model with independent Smithsonian satellite drag data indicates good agreement in the months from May to September. The deep midyear minimums of the semiannual effect do not occur simultaneously for all satellites (not even in the same months). A large semiannual effect amplitude was uncovered at low altitude in data from satellite Secor 6 (perigee altitude 190 km) that is appreciably greater than indicated by existing model atmospheres. The model predicts an even larger amplitude than that of Secor 6 for satellite Injun 3 (perigee altitude 249 km) which is supported by drag data. However, the model evidently does not provide a complete explanation of the semiannual effect. Apparently, heating associated with geomagnetic perturbations plays a major role in the semiannual effect around the equinoxes. Author

N70-11798# Army Foreign Science and Technology Center, Washington, D.C.

THE ROLE OF SOILS IN THE INTERPRETATION OF ARID-ZONE LANDSCAPES FROM AERIAL PHOTOGRAPHS

Yu. S. Tolchelnikov [1969] 12 p refs Transl. into ENGLISH of a Russian publication
(AD-692656; FSTC-HT-23-492-69) Avail: CFSTI CSCL 14/5

The characteristics of soil cover are closely related with all components of the landscape, refracting the specifics of the geologic and geomorphologic structure of the territory, hydrological conditions, migration of chemical compounds, composition of vegetative cover, etc. Examples of interpretation of aerial photographs are given. Author (TAB)

N70-11799# Army Natick Labs., Mass. Earth Sciences Lab.

PHYSICAL GEOGRAPHY AND MILITARY ENVIRONMENT IN A TRANSECT OF THE UTAH AND COLORADO ROCKIES

Will F. Thompson May 1969 185 p refs *Its* Ser. ES-46
(AD-693244; TR-69-73-ES) Avail: CFSTI CSCL 8/6

The crests and slopes of mountain ranges, and basin floors intervening between them, along U.S. Route 40 between Salt Lake City and the Denver-Boulder area, are described here by means of text, 70 photographs, and 8 maps with climatic and topographic data. The bibliography contains 570 entries. All of the highly varied terrain of the study transect is found to be accessible to military forces, and it could all be involved to one degree or another in any warfare which might occur there. Actual warfare in the study transect is not envisioned, but combat in analogous Eurasian terrain is a possibility which cannot be discounted for various reasons. Particular features of the terrain are examined and

discussed here with respect to the nature and extent of their characteristic environmental rigors, their trafficability, the prevalence of defile problems, and the potential usefulness of aerial mobility. It is concluded that small irregular forces are at great advantage in high mountain terrain as compared with large regular formations, and that the military advantages of advanced technology have until now been minimal there, but that aerial mobility, which bypasses defiles, will alter that situation in the near future. Author (TAB)

N70-11823*# Southern Methodist Univ., Dallas, Tex. Dept. of Geological Sciences.
STABILITY OF SILICATE MINERALS Final Report, 1 Feb. 1966 - 1 Jun. 1968
Michael J. Holdaway Feb. 1969 20 p
(Grant NGR-44-007-006)
(NASA-CR-106967) Avail: CFSTI CSCL 08G

The stability of epidote, a calcium iron aluminum silicate as a function of pressure, temperature, and oxygen fugacity was investigated. The experimental results of progressively reducing conditions are reported as: (1) epidote decomposition proceeds at a lower temperature for a given pressure; (2) equilibrium epidote becomes more aluminous and its almandine content increases; (3) garnet in the reaction products becomes more aluminous and contains more ferrous iron; and (4) the iron oxide mineral in the reaction products changes from hematite to magnetite to hercinite, and eventually corundum occurs. Author

N70-11871# Air Force Cambridge Research Labs., Bedford, Mass.
ON THE APPLICATION OF AIR-COUPLED SEISMIC WAVES
Francis A. Crowley and Henry A. Ossing Jul. 1969 43 p refs
Its Environ. Res. Papers No. 302
(AD-693132; AFCRL-69-0312) Avail: CFSTI CSCL 8/13

Seismic measurements taken on Rogers Lake Playa, Edwards AFB, California, were prompted by a concern that ground vibrations excited by F-1 rocket engines might affect the role of playa cracking. These measurements relate to other Air Force interests. Specifically, the note characterizes seismic waves excited by F-1 rockets, sonic booms, and atmospheric explosions to (1) Playa landing areas (2) Ground conditions affecting sonic booms and rocket firings sensed in buildings (3) Detection of acoustic sources using seismic systems (4) The playa's selective distortion of acoustic wave characteristics and (5) Consideration of a playa seismic alarm system. Author (TAB)

N70-11927*# Little (Arthur D.), Inc., Cambridge, Mass.
DEVELOPMENT OF A THEORY OF THE SPECTRAL REFLECTANCE OF MINERALS Final Report
J. R. Aronson and A. G. Emslie Oct. 1969 104 p refs
(Contract NAS9-8396)
(NASA-CR-102009; ADL-C-70544) Avail: CFSTI CSCL 08G

A theory of the reflectance of mixtures of particulate materials was developed. The methods of geometrical optics were used to compute the components of the theory when the particle size is coarse compared to the radiation wavelength, while an approach based on Bragg scattering and the Lorentz-Lorenz theory of dielectrics is used for fine-particulate materials. Separate comparisons of these theories and experimental data for coarse quartz powder and fine corundum powder indicate that the infrared spectral shapes of the materials can be predicted for the most part using the appropriate regimes of the theory. In addition, the theory predicts qualitatively many of the particle-size dependent changes in the spectra. A criterion for a decision as to the regime of applicability of each of the two theories was discovered and it was found to fit the experimental data qualitatively. The theory was programmed for rapid computation using high speed digital computers. A Michelson interferometer was used to gather emission data for a limited number of materials. Author

N70-11944# Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
EXPEDITION ODYSSEUS 65: TRITIUM AND RADIOCARBON IN THE MEDITERRANEAN AND BLACK SEAS
H. Goete Oestlund Nov. 1969 30 p refs
(Grant NSF GP-4783)
(ML-69167) Avail: CFSTI

Water samples from several depths were taken from the Black Sea, Sea of Marmara, Mediterranean Sea, and Atlantic Ocean, and the amounts of carbon 14 and tritium were determined. Emphasis was placed on Black Sea data. It was determined from C-14 data that the bottom water of the Black Sea remains there about 1000 years and that water in the thick layer above stays about 900 years. The data also indicate that C-14 is beginning to penetrate most water masses in the Mediterranean. Results also show the presence of tritium in the surface waters of all areas except the western Mediterranean and the Atlantic. N.E.N.

N70-11980*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSSIBLE RELATIONS BETWEEN METEORITE IMPACT AND IGNEOUS PETROGENESIS, AS INDICATED BY THE SUDBURY STRUCTURE, ONTARIO, CANADA
Bevan M. French Aug. 1969 54 p refs Submitted for publ.
(NASA-TM-X-63737; X-644-69-371) Avail: CFSTI CSCL 08G

Geological and experimental studies demonstrated that rocks subjected to intesne shock waves produced by hypervelocity meteorite impacts and by nuclear or chemical explosions develop distinctive and unique shock meta-morphic features, including: (1) high-pressure minerals such as coesite and stishovite; (2) high-strain-rate crystal-lattice deformation features such as isotropic feldspar (maskelynite) and planar features (shock lamellae) in quartz; and (3) ultrahigh-temperature reactions such as decomposition of zircon to baddeleyite and melting of quartz to lechatelierite. These petrographic features, currently regarded as unequivocal evidence for meteorite impact, are preserved and recognized even in very old and deeply eroded structures. Such features have now been observed in more than 50 crypto-explosion structures ranging in size from 2 km to more than 60 km in diameter. Author

N70-12018# Coast Guard, Washington, D.C. Oceanographic Unit.
OCEANOGRAPHIC OBSERVATIONS, NORTH ATLANTIC STATION BRAVO, OCTOBER 1966 - OCTOBER 1967
Joseph L. Shuhy Jul. 1969 42 p refs
(AD-692967; CG-373-20) Avail: CFSTI CSCL 8/10

The report contains the observed and interpolated temperature and salinity data, plus the computed sigma plus or minus, geopotential anomalies and sound velocities for 125 oceanographic stations taken by seven U.S. Coast Guard Cutters occupying Ocean Station BRAVO (centered at 56 deg. 30 min. N., 51 deg. 00 min. W.) during October 1966-October 1967. They were the USCGC DUANE, 8-28 October 1966; USCGC McCULLOCH, 24 November-12 December 1966; USCGC HUMBOLDT, 7-31 January 1967; USCGC BIBB, 24 February-14 March 1967; USCGC ESCANABA, 6-24 April 1967; USCGC SPENCER, 27 May-6 June 1967; USCGC SEBAGO, 29 June-21 July 1967; USCGC McCULLOCH, 14 August-5 September 1967; USCGC SPENCER, 29 September-23 October 1967. Casts of 14 levels were made to 1,500 meters when weather and operating conditions permitted. An attempt was made to extend sampling to near the bottom once on each patrol. Author (TAB)

N70-12100# Groupe de Recherches Ionospheriques, Issy-les-Moulineaux (France).
WIND MEASUREMENTS IN THE LOWER IONOSPHERE OBSERVED BY MEANS OF METEOR TRAILS: PART 1 [ETUDE DES VENTS DE PETITE ECHELLE OBSERVES AU MOYEN DES TRAINEES METEORIQUES, PREMIERE PARTIE]
I. Revah (Ph.D. Thesis--Paris Univ.) Nov. 1968 102 p refs In FRENCH
(GRI-NT-77-Pt-1) Avail: CFSTI

Methods for measuring winds in the lower ionosphere are

discussed and the method used at the Centre National d'Etudes des Télécommunications (CNET) is described. It is based on the reflection of a continuous wave emitted by a radar on meteorite dust clouds. This device gives the possibility of a great number of observations in a short time and an accuracy in positioning the reflection point of less than 1 km. Gravity waves have also been analyzed together with the temperature discontinuity. Future projects using continuous wave radar are presented. ESRO

N70-12130# Joint Publications Research Service, Washington, D.C.

RESULTS OF OPTICAL OBSERVATIONS

In its Upper Atmosphere and Space Res. in the USSR in 1968 1 Aug. 1969 p 38-41 (See N70-12126 02-30)
Avail: CFSTI

Visual, photographic, and photometric observations by satellites were carried out for geophysical and geodetic areas. Analyses of fluctuations in the earth's upper atmosphere established variations in solar radiation as the main reason. Work continued on the use of photographic observations of satellites for solving geodetic problems and a method was developed for determining the coordinates of individual stations by interpolation of orbits. G.G.

N70-12178*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AIRBORNE LASER-RADAR STUDIES OF THE LOWER ATMOSPHERE

Samuel H. Melfi and Joseph W. Stickle Washington Dec. 1969 57 p refs
(NASA-TN-D-5558) Avail: CFSTI CSCL 04A

A theoretical model of ruby laser radiation backscatter with a wavelength of 0.6943 mum in the lower atmosphere was developed. This model accounts for scattering from air molecules and atmospheric aerosols. Molecular scattering appears to predominate over aerosol scattering in the altitude range from 4 to 14 km. Above 14 km, an aerosol layer increases the scattering by approximately a factor of 2 above Rayleigh (molecular) predictions. An airborne laser system was developed and flown from near sea level to an altitude of 11 km. The results of these airborne measurements agreed well with the model predictions. This investigation was initiated to investigate the possible correlation between molecular or aerosol density fluctuations due to clear air turbulence and laser radar return from the atmosphere; however, no correlation was obtained. This result, however, does not preclude using laser backscatter systems as atmospheric probes, since the system used in the present investigation was extremely insensitive to the detection of molecular or aerosol density fluctuations. By using the results of this investigation and the theoretical model, an analysis of a general airborne laser system was performed. This analysis indicated that use of an improved system with better sensitivity and which is within the state of the art would make the airborne laser system a valuable tool for investigation of atmospheric phenomena associated with molecular and aerosol density changes. Author

N70-12217*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ON THE SEMIANNUAL VARIATION OF THE UPPER ATMOSPHERE

Isadore Harris and Wolfgang Priester (NASA. Goddard Inst. for Space Studies) Oct. 1968 36 p refs Revised
(NASA-CR-107032) Avail: CFSTI CSCL 04A

Several possible mechanisms are investigated which could be invoked to explain the observed semiannual density variation in the thermosphere and exosphere. A variation of the height of the mixtopause leads to a large density variation for heights above 700 km. Below that height, however, the density is essentially invariant to this process. This invariance is to some degree caused by the neglect of downward heat transport by eddy diffusion at the bottom of the thermosphere. The limitations of using the simple mixtopause scheme in this context are discussed. Another mechanism can be ruled out on the grounds that it fails to explain the observed amplitude at a height of 200 km. This mechanism is a small permenent heat flux conducted into the lower exosphere from above. The recent observations at heights below 200 km indicate that the temperature and density at the bottom of the thermosphere (90 to 120 km) vary with a semiannual period. Author

N70-12240# Institut Royal Météorologique de Belgique, Brussels.

IONOSPHERIC AND COSMIC RAY OBSERVATIONS FEBRUARY 1969 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE, FEVRIER 1969.] Monthly Bulletin
1969 28 p In FRENCH and DUTCH
Avail: CFSTI

Ionospheric and cosmic ray data derived from observations made at Dourbes (Belgium) in February 1969 are given. ESRO

N70-12248# Groupe de Recherches Ionosphériques, Issy-les-Moulineaux (France).

WIND MEASUREMENTS IN THE LOWER IONOSPHERE OBSERVED BY MEANS OF METEOR TRAILS. PART 2: GRAPHS AND APPENDICES [ETUDE DES VENTS DE PETITE ECHELLE OBSERVES AU MOYEN DES TRAINEES METEORIQUES. DEUXIEME PARTIE: FIGURES ET APPENDICES]

I. Revah (Ph.D. Thesis-Paris Univ.) Nov. 1968 152 p In FRENCH Sponsored by CNES
(GRI-NT-77-Pt-2) Avail: CFSTI

This report contains the graphs and appendices of GRI-NT-77, Part 1. ESRO

N70-12263*# National Academy of Sciences-National Research Council, Washington, D.C. Div. of Earth Sciences.

SEISMOLOGY: RESPONSIBILITIES AND REQUIREMENTS OF A GROWING SCIENCE. PART 1: SUMMARY AND RECOMMENDATIONS

1969 45 p Sponsored in part by AROD, AEC, ARPA, ESSA, NSF, and US Geol. Survey
(Contract NSR-09-012-915)
(NASA-CR-107020) Avail: CFSTI CSCL 08K

The current status and role of seismology in society, a forecast of the future role, and recommendations for developing the technical capability required to meet current and future needs are summarized. Means of attaining the goals of mitigating, predicting, and even preventing earthquakes are described, as well as increased investigation of the earth's crust and deep interior. The capabilities of the future observational and laboratory facilities, and the research and training facilities at universities are outlined. Some of the uses of seismology are identified and as exploration of underwater, oil, and mining resources, and state and federal interests are reviewed. Graduate students and graduate programs, and federal funding in seismological research are also covered. N.E.R.

N70-12264*# National Academy of Sciences-National Research Council, Washington, D.C. Div. of Earth Sciences.

SEISMOLOGY: RESPONSIBILITIES AND REQUIREMENTS OF A GROWING SCIENCE. PART 2: PROBLEMS AND PROSPECTS

1969 67 p refs Sponsored in part by AROD, AEC, ARPA, ESSA, NSF, and US Geol. Survey
(Contract NSR-09-012-915)
(NASA-CR-107026) Avail: CFSTI CSCL 08K

The main areas of research effort and interest, and the main applications of seismology in the past and present are reviewed, and projections for the future are attempted. Discussions are given on earthquake geography; research on the interiors of the earth, moon, and planets; earthquake-caused tsunamis, landslides, and volcanism; earthquake engineering and underground nuclear explosion detection; theoretical studies of seismic waves and calculation of their velocity, vibration, and source; instrument development; seismological networks and laboratories; and industrial applications. N.E.R.

N70-12269# European Space Research Inst., Frascati (Italy).
DEFORMATION OF A MAGNETIC DIPOLE FIELD BY TRAPPED PARTICLES
K. Lackner Oct. 1969 43 p refs Submitted for publication
(ESRIN-IN-52) Avail: CFSTI

Experimental results underline the necessity for a self-consistent (non linear) ring current analysis even for moderate geomagnetic storms. A model for stationary, symmetric ring currents based on a solution of Vlasov's equation for a quasineutral plasma is presented. Results give a quantitative relation between the energy of the trapped particles, the disturbance field on the earth's surface and the magnetic disturbance energy. The limiting mechanism for the growth of the ring current belt is discussed. ESRO

N70-12294# Groupe de Recherches Ionosphériques, Issy-les-Moulineaux (France).
STUDY OF THE F REGION DYNAMICS BY THOMSON SCATTERING [ETUDE PAR DIFFUSION DE THOMSON DE LA DYNAMIQUE DE LA REGION F]
G. Vasseur 15 Jul. 1968 87 p refs In FRENCH
(GRI-NT-74) Avail: CFSTI

The method used at Nancay (France) to study transport properties in the F region is presented and the importance of the phenomena is stressed. Experimental results are presented in the form of about twenty diurnal variation curves of the ionization rates. These rates are discussed and two separate effects are distinguished: (a) horizontal atmospheric circulation and (b) ambipolar diffusion due to gravity and partial pressure of the ionized gas. The influence of atmospheric winds on the maximum density of the F2 layer is also analyzed. ESRO

N70-12340# Liverpool Univ. (England). Dept. of Mechanical Engineering.
A SURVEY OF FLUID FLOW AND HEAT TRANSFER IN ROTATING DUCTS
Henry Barrow 1969 29 p refs Supersedes ARC-30525
(ARC-CP-1054; ARC-30525) Avail: HMSO 6s 6d; BIS $1.30

This paper is intended as an introduction to the study of fluid flow and heat transfer in rotating ducts, and to serve as a basis for discussion of this field of work. The interest in this subject results mainly from the need to determine heat transfer between the surfaces of ducts or passages in the components of rotating machines and a confined or flowing fluid. There are numerous situations in the engineering field where this type of problem occurs. The fluids in these convection problems may be liquid or gas, and in some cases heat transfer may be accompanied by phase change as in the case of internal cooling of a turbine blade by coolant evaporation. A wide range of liquids has to be studied because of the importance of this problem in the chemical industry. Gases other than air are of interest here also. Author (ESRO)

N70-12359# Groupe de Recherches Ionosphériques, Issy-les-Moulineaux (France).
LIST OF VLF EMISSIONS DETECTED AT KERGUELEN (TAAF), SOGRA (USSR), LAVANGSDALEN (NORWAY) AND CHAMBON-LA-FORET (FRANCE) FROM 1964 to 1968. PART 2: LIST OF VLF EMISSIONS FROM AIR AND DAWN CHORUS MEASURED AT KERGUELEN (TAAF) AND PAVLOVA-SOGRA (USSR) DURING THE PERIOD RECORDED FROM MARCH 1968 TO APRIL 1968 [LISTE DES EMISSIONS TBF DETECTEES A KERGUELEN (TAAF) ET SOGRA (URSS), LAVANGSDALEN (NORVEGE) ET CHAMBON-LA-FORET (FRANCE) DE 1964 A 1968. DEUXIEME PARTIE: LISTE DES EMISSIONS TBF DE SOUFFLE ET DE CHOEUR DE L'AUBE DETECTEES A KERGUELEN (TAAF) ET PAVLOVA-SOGRA (URSS) DURANT LA PERIODE D'ENREGISTREMENTS REALISES DU 1ER MARS 1968 AU 1ER AVRIL 1968]
Monique Thiel, Jacques Thiel, Jacques Vigeron, Natacha Kleimenova (Inst. de Physique du Globe, Moscow), and Rene Blondeau (CNET) et al 7 Jul. 1969 92 p In FRENCH Sponsored by Acad. des Sci. de USSR, Comite Inter-Cosmos, Inst. de Phys. du Globe de Moscou, Comite Natl. Franc. des AISC, CNES, and CNRS
(GRI-NTP-49) Avail: CFSTI

Daily ground measurements carried out simultaneously at Kerguelen and Sogra (USSR) on ionospheric VFL emissions are tabulated for the period 1 to 31 March 1968. The times of the start and the finish of the activity are indicated and also the time at which the maximum occurred. Slow magnetic variations are also recorded in conjunction with sunrise and sunset. ESRO

N70-12376# Institut d'Aéronomie Spatiale de Belgique, Brussels.
THE POLARIZED ELECTRIC FIELD IN THE POLAR ION-EXOSPHERE [LE CHAMP ELECTRIQUE DE POLARISATION DANS L'EXOSPHERE IONIQUE POLAIRE]
Jean Lemaire and M. Scherer 1969 10 p refs In FRENCH; ENGLISH summary Submitted for publication *Its* Aeronomica Acta No. A-62-1969
Avail: CFSTI

The potential and electric field distributions in the polar ion-exosphere have been determined in such a way to provide 1) the equality of the evaporative fluxes of positively and negatively charged particles and 2) the quasi-neutrality of the plasma in the exosphere. It is found that the Pannekoek and Rosseland polarization electric potential is not appropriated to the polar exosphere and that the exospheric mean velocity of the H(+) ions is smaller than that obtained in the 'polar wind' and 'polar breeze' models. Author (ESRO)

N70-12386# Aerospace Corp., El Segundo. Lab. Operations.
A THEORETICAL STUDY OF THE 27-DAY VARIATION OF UPPER-ATMOSPHERIC TEMPERATURE Technical Report, Jul. 1968 - Feb. 1969
Barbara K. Ching and Gary E. Thomas (Colo. Univ., Boulder) 15 Jul. 1969 33 p refs
(Contract F04701-69-C-0066)
(AD-693124; , TR-0066(5110-01)-2; TR-0200(4110-01)-2; SAMSO-TR-69-215) Avail: CFSTI CSCL 4/1

The temperature of the upper atmosphere, as observed by satellite-drag analysis, lags the maximum of the 27-day variation in solar decimeter flux by about 1 day. This time lag is now generally interpreted to be an atmospheric reaction time in response to the varying solar extreme ultraviolet (EUV) heating. The EUV flux has been observed from satellites to be closely proportional to the decimeter flux. A reexamination of Roemer's time-lag data from six satellites indicates that the apparent dependence on local time seen by Roemer is probably not significant in view of the large uncertainties. The present analysis examines the theoretical evidence for a 1.4-day time lag. This is accomplished by means of a simple analytic solution of the heat conduction equation in a suitably averaged atmospheric model. Author (TAB)

N70-12413# Emmanuel Coll., Boston, Mass. Oriental Science Research Library.
CARTOGRAPHIC REPRESENTATION OF LOESS LANDFORMS ON LARGE-SCALE MAPS
Mei-Xin Jiang et al Bedford, Mass. AFCRL Jul. 1969 40 p refs Transl. into ENGLISH From Acta Geodetica et Cartographica Sinica (China), v. 9, no. 1 1966 p 44 62
(Contract F19628-68-C-0251)
(AD-693133; EMM-68-188; AFCRL-69-0313; AFCRL-Trans-53) Avail: CFSTI CSCL 8/2

The paper describes the geographical distribution of loess and the associated characteristics and explains the meaning of representation of loess landforms on large-scale maps. The various types of loess landform are systematically classified and tabulated. The classification of types required for the preparation of topographical maps is achieved through field experiments. Loess landforms, such as valley, plateau, ridge, knoll and platform, their characteristics and contour profiles are examined. The principles of

cartographic representation and synthesis are discussed. Configurations from similar type regions are presented as examples. Author (TAB)

N70-12449# Kiruna Geophysical Observatory (Sweden).
A SYSTEM FOR AUTOMATIC COLLECTION AND PROCESSING OF GEOMAGNETIC DATA IN DIGITAL FORM Final Scientific Report, 15 Feb. - 14 Feb. 1969
Georg Gustafsson Apr. 1969 21 p refs
(Contract AF 61(052)-866)
(AD-690632; KGO-692; AFCRL-69-0269) Avail: CFSTI CSCL 9/2

A review has been carried out of the work made during the contract period. The report contains details of the measurements made. A summary of the equipment given in earlier reports. A summary of the computer handling of the data and suggestions and plans for the future. Author (TAB)

N70-12483# Utah State Univ., Logan. Electro-Dynamics Labs.
RESEARCH IN NON-EQUILIBRIUM RADIATIVE PROCESSES Final Report, 7 Jun. 1966 - 31 Dec. 1968
Doran J. Baker, A. T. Stair, Jr., William R. Pendleton, Jr., E. Ray Huppi, and Carl F. Zitlau 31 Jan. 1969 79 p refs
(Contract AF 19(628)-5916)
(AD-693206; AFCRL-69-0137) Avail: CFSTI CSCL 4/1

The primary objective has been to investigate, or develop improved means for investigating, phenomena of interest to a basic understanding of certain aspects of the aerospace environment, particularly those involving optical emissions. The central approach to the attainment of this objective has been by laboratory-based studies of the mechanisms responsible for the radiative phenomena. The purpose of the effort has been to improve our understanding of the basic atomic and molecular processes in the hope that eventually related macroscopic atmospheric properties, directly applicable to Air Force problems, can be reliably predicted. Phenomena which have been investigated in the laboratory include vibrational relaxation in pure gases and in gas mixtures and excitation in collisions of energetic ions and neutrals with low-pressure targets of atmospheric gases. The variations in the intensity of OH emissions from the night sky have been studied. The development of a high-intensity supersonic nozzle beam for use in the study of problems of interest in chemical physics has been pursued. Author (TAB)

N70-12484# Florida State Univ., Tallahassee. Dept. of Meteorology.
STRATOSPHERIC OZONE AND CIRCULATION Final Report, 1 Apr. 1968 - 28 Feb. 1969
Richard A. Craig and John H. Clark 31 May 1969 49 p refs
(Contract F19628-68-C-0112)
(AD-692759; AFCRL-69-0217; Rept-69-3) Avail: CFSTI CSCL 4/1

Thirteen ozone soundings with Mast instruments and fifteen Umkehr measurements were obtained during 1968. A model for the vertical distribution of ozone is described. A procedure for and the results of fitting this model to our soundings, and to mean soundings at other locations, is described. A procedure for comparing balloon measurements and simultaneous Umkehr measurements is also outlined. The essential point in this procedure is to compute Umkehr curves from the balloon measurements, rather than vice versa. A stratospheric model employing quasi-geostrophic dynamics and simplified terms representing radiative-photochemical effects is presented. The spectral method is used for solution. The model is integrated for 230 days from an initial state of radiative-photochemical equilibrium. A redistribution of ozone similar to the observed one is outlined, accomplished largely by large-scale quasi-horizontal eddies. The energy cycle is studied in detail and the study reveals the overwhelming importance of energy supplied to the stratosphere from the troposphere. Author (TAB)

N70-12493# Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
SAND MOVEMENT IN RELATION TO BEACH TOPOGRAPHY
David S. Mc Arthur 30 Jun. 1969 34 p refs
(Contract Nonr-1575(03))
(AD-693123; TR-67) Avail: CFSTI CSCL 8/6

Tracer experiments were conducted on the Gulf Coast beach of Hurricane Island, Florida, to obtain information on sediment transfer between foreshore, trough, and bar topography. Concurrent measurements of waves and currents were collected. Along-shore transport of tracer released in the three topographic zones was greater than normal-to-shore movement, even when the angle between wave crests and the shoreline was small. Seaward movement of tracer placed in the trough and bar zones took place during alongshore transport only when waves broke on the bar, and was most marked when wave steepness had a value near 0.04. During these conditions tracer released in the trough moved onto and along the bar crest. At other times landward displacement of bar and trough tracer accompanied alongshore transport. Tracer placed on the bar moved into the trough. Only when a subaqueous shoal replaced the trough immediately seaward of the beach step did appreciable amounts of tracer seaward from the foreshore. Rhythmic topography appears, therefore, to provide an important mechanism for onshore-offshore movement of sediment within a beach system. Transport of tracer from the trough and bar onto the foreshore was negligible over all experiments. Author (TAB)

N70-12503# Aerospace Corp., El Segundo, Calif.
ENERGY DEPENDENCE OF THE AVERAGE HIGH LATITUDE CUTOFF OF TRAPPED ELECTRONS
R. N. Davie and A. L. Vampola 8 Aug. 1968 16 p refs
(Contract F04701-69-C-0066)
(AD-693560; TR-0066(5260-20)-5; SAMSO-TR-69-226) Avail: CFSTI CSCL 4/1

The energy-dependence of the average high-latitude cutoff of trapped electrons during the period August 1966 to September 1967 was determined on the basis of data obtained from the magnetic spectrometer onboard polar satellite OV3-3 (1966-70A). The cutoff latitude decreases as the energy increases between 300 keV to 2.0 MeV. The cutoffs are compared with a theoretical calculation of Taylor, and with the magnetospheric models of Williams and Mead, and Taylor and Hones. Author (TAB)

N70-12519# Geological Survey, Denver, Colo.
SOME PHYSICAL PROPERTIES OF ROCKS IN DRILL HOLE UAe-6c, AMCHITKA ISLAND, ALASKA
William H. Lee Jun. 1969 14 p ref
(Contract AT(29-2)-474)
(USGS-474-33) Avail: CFSTI

Physical properties of rocks from drill hole UAe-6c were analyzed by averaging and minimum-maximum ranging of data derived from Birdwell 3-D log computations. These physical properties and U. S. Geological Survey laboratory determinations of physical properties are presented in table form. Rocks in the drill hole were divided into 13 lithologic types for purposes of analysis. The physical property data of similar lithologic types were compared. The physical property trends indicate that age and depth of burial have some influence on the individual physical properties. Author (NSA)

N70-12521# Columbia Univ., Palisades, N.Y. Lamont-Doherty Geological Observatory.
MIXING, DIFFUSION, AND CIRCULATION RATES IN OCEAN WATERS Annual Progress Report
Jun. 1969 383 p refs
(Contract AT(30-1)-2663)
(CU-2663-10) Avail: CFSTI

Geochemical research efforts aimed at defining the major chemical cycles in the world ocean were continued by studying the carbon cycle, by measuring the radon and radium content of the oceans in order to understand the interaction of the atmosphere and ocean surface and by fallout studies, particularly the measurement of Cs-137, Sr-90, and tritium. The physical oceanography program

for investigating the features of ocean circulation was carried out at six different field locations using measurements of dye diffusion, temperature and moisture content, carbon content, and surface winds. The results of these experiments are presented as separate papers. Author (NSA)

N70-12522# Geological Survey, Denver, Colo.
SUMMARY GEOLOGIC REPORT ON THE Ue13a DRILL HOLE, EASTERN BELTED RANGE, NYE COUNTY, NEVADA
K. A. Kargent Jun. 1969 6 p ref
(Contract AT(29-2)-474)
(USGS-474-29) Avail: CFSTI

Drill hole Ue13a, located on the eastern side of the Belted Range, north of Oak Spring Butte, was completed in volcanic rocks at a total depth of 741 feet. The static water level is 425.5 feet below the surface. The lithologic and stratigraphic units penetrated in Ue13a are illustrated. Author (NSA)

N70-12525*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
NORTH AMERICAN DATUM IN VIEW OF GEOS 1 OBSERVATIONS
Ivan I. Mueller, James P. Reilly, and Charles R. Schwarz Jun. 1969 41 p refs
(Grant NGL-36-008-093)
(NASA-CR-107103; Rept-125) Avail: CFSTI CSCL 08E

During the lifetime of the GEOS I satellite a large number of optical and electronic observations were made from stations located on the North American Datum (NAD). The NAD coordinates of most of these stations have been determined through precise geodetic ground ties to the first-order triangulation network. An attempt is made to determine the coordinates of these stations from the available satellite observations and possible distortions present in the North American Datum. The coordinates were determined both from simultaneous observations (geometric mode) and from observations distributed along the orbital path (short-arc mode). All coordinate computations (and results) are relative to the NAD coordinates (and variances) of Columbia, Missouri, the station nearest to the origin of the NAD: Meades Ranch, Kansas. On the other hand, the parameters, defining the distortions of the NAD with respect to the satellite determined system, refer to Meades Ranch. Author

N70-12527# Groupe de Recherches Ionosphériques, Issy-les-Moulineaux (France).
LIST OF VLF EMISSIONS DETECTED AT KERGUELEN (TAAF), SOGRA (USSR), LAVANGSDALEN (NORWAY) AND CHAMBON-LA-FORET (FRANCE) FROM 1964 TO 1968: PART 1 [LISTE DES EMISSIONS TRF DETECTEES A KERGUELEN (TAAF), SOGRA (URSS), LAVANGSDALEN NORVEGE) ET CHAMBON-LA-FORET DE 1964 A 1968: PREMIERE PARTIE]
Monique Thiel, Jacques Thiel, Jacques Vigneron, Natalia Nelmonova (Inst. of Terrest. Phys. of Moscow), René Blondeau (CNET) et al 25 Jan. 1969 115 p In FRENCH Supported jointly by the Acad. of Sci. of USSR, Intercosmos, Inst. of Terres. Phys. of Moscow, Comité Natl. Franc. des AISC, the CNES and the CNRS
(GRI-NTP-48) Avail: CFSTI

Ground measurements carried out simultaneously at Kerguelen and Sogra (USSR) on ionospheric VLF emissions are tabulated for the period 1964 to February 1968. The times of start and finish of the activity are indicated and also the time at which the maximum occurred at both stations. ESRO

N70-12552# Naval Oceanographic Office, Washington, D.C.
BENTHOS DISTRIBUTION IN THE CENTRAL AND SOUTHERN CASPIAN [RASPREDELENIE BENTOSA V SREDNEM I YUZHNOM KASPII]
N. N. Romanova 1968 25 p refs Transl. into ENGLISH from Zool. Zh. (Moscow), v. 39, no. 6, 1960 p 811-825
(AD-693581; NOO-Trans-400) Avail: CFSTI CSCL 8/1

The benthos biomass in central and southern Caspian is unevenly distributed. Eastern shore and the area of the Apsheron peninsula in central Caspian and western shore in southern Caspian are rich in benthos. The central deep water portion is characterized by a low biomass value, under 1 g/sq m. It is the mollusks which prevail by weight in the benthos of central and southern Caspian making about 90% of the former and over 90% of the latter sector. Gammarids and corophids attain an appreciable development in central Caspia, while the role played by them in the benthos of southern Caspian is very small. Nereis diversicolor introduced to both central and southern Caspian achieved a considerable development (0.6-0.8g/sq m). High indices of total biomass of the eastern shore of central Caspian (200 g/sq m) are due mainly to the vigorous development of Mytilaster lineatus and Dreissena distincta. Despite some increase of the total biomass both in central and southern Caspian in 1956, when compared to that in 1933-1939, the food value of the marine benthos increased due to the biomass increase of Mytilaster lineatus and to the appearance of Nereis diversicolor. Author (TAB)

N70-12553# Coast Guard, Washington, D.C. Oceanographic Unit.
OCEANOGRAPHIC OBSERVATIONS, NORTH ATLANTIC OCEAN STATION DELTA, 44 DEG N 41 DEG W, JULY 1966 - AUGUST 1967
David M. Husby 1968 171 p
(AD-692874; USCG-373-23) Avail: CFSTI CSCL 8/10

The report contains the observed and interpolated temperature and salinity data plus the computed sigma-t, geopotential anomalies and sound velocities for 136 oceanographic stations occupied by U.S. Coast Guard cutters at Ocean Station DELTA (centered at 44 deg N., 41 deg 00 min W.) during July 1966-August 1967. They were the USCGC ESCANABA (WHEC 64), 15 July-2 August 1966; USCGC CAMPBELL (WHEC 32), 27 August-16 September 1966; USCGC HUMBOLDT (WHEC 372), 12 October-2 November 1966; USCGC CHINCOTEAGUE (WHEC 375), 26 November-17 December 1966; USCGC DUANE (WHEC 33), 10-31 January 1967; USCGC CASCO (WHEC 370), 20 Mar-11 April 1967; USCGC OWASCO (WHEC 39), 26 May-17 June 1967; and USCGC SPENCER (WHEC 36), 11 July-3 August 1967. Daily casts of 14 to 15 Nansen bottles were made to a desired depth of 1,500 meters when weather conditions permitted. Author (TAB)

N70-12554# Ohio State Univ., Columbus. Dept. of Geodetic Science.
FURTHER STUDIES IN THE COMBINATION OF GRAVIMETRIC AND SATELLITE DATA
Richard H. Rapp Dec. 1968 45 p refs
(Contract AF 19(628)-57)
(AD-693205; Scientific-27; DGS-119; AFCRL-69-0249) Avail: CFSTI CSCL 8/5

The report is composed of two portions. The first is a general theoretical discussion of the problem of assuming compatibility of surface gravity data and potential coefficients derived from satellite orbital analysis. The second part of the report describes a combination of gravimetric and satellite data using 5 degrees x 5 degrees mean free air anomalies supplied by the Aeronautical Chart and Information Center, and a set of potential coefficients designated NWL 81 derived by Anderle. Several methods were applied to this data to obtain an adjusted set of potential coefficients complete to $n = 15$ plus an additional number of higher degree resonance terms. In addition three sets of adjusted 5 degrees x 5 degrees mean free air anomalies were obtained. From these anomalies a set of potential coefficients complete to $n = 30$ was derived by the development formulas. Analysis of the various solutions indicated that one was to be preferred over all others. Problems continue to remain with respect to proper weighting of the data. Author (TAB)

N70-12607# Naval Oceanographic Office, Washington, D.C.
VERTICAL ZONALITY OF FISH DISTRIBUTION IN THE

UPPER BATHYAL OF THE SEA OF OKHOTSK [VERTIKALNAYA ZONALNOST V RASPREDELENII RYB V VERKHNEI BATIALI OKHOTSKOGO MORYA]
V. P. Shuntov 1968 22 p refs Transl. into ENGLISH from Zool. Zh. (Moscow), v. 44, no. 11, 1965 p 1678 - 1689
(AD-693580; NOO-Trans-391) Avail: CFSTI CSCL 8/1

Within the upper bathyal of the Okhotsk Sea several fish groups are distinguished, whose distribution peculiarities are determined by that of water masses. An analysis of the distribution of several dozens of fish species shows the most drastic change in the species composition at the border line of water masses (200 and 600m). At depths below 600-700m, fish fauna is very improverished due to oxygen deficiency in these horizons. The problem of fish stock supply within the bathyal of the Okhotsk Sea is discussed. The complex of unfavorable factors (extreme severity of sea, the character of the current system, low biomass of benthos) is responsible for a low population of benthophages as well as of planktonphages and predators. Author (TAB)

N70-12608# Naval Oceanographic Office, Washington, D.C.
QUANTITATIVE DISTRIBUTION OF BENTHOS IN THE EASTERN BERING SEA [KOLICHESTVENNOYE RASPREDELENIYE BENTOSA V VOSTOCHNOY CHASTI BERINGOVA MORYA]
A. A. Neiman 1968 22 p refs Transl. into ENGLISH from Zool. Zh. (Moscow), v. 39, no. 9, 1960 p 1281 - 1292
(AD-693582; NOO-Trans-402) Avail: CFSTI CSCL 8/1

In August-September benthos sampling on the shelf and the upper portion of the slope was carried out in the eastern part of the Bering Sea. Altogether, 104 dredge stations were occupied at depths from 20 to 500m. The mean benthos biomass in this region makes up 74.4g/sq. m, the main part consisting of bivalves and echinoderms. Qualitatively, the benthos of the investigated area can be divided into two complexes: low-arctic and boreal ones. Low-arctic complex achieves its greatest development in the northwestern part of the area investigated where it stretches from the shore to the isobath of 100m, while in the southeastern part it is situated in the narrow band at the depth of 50 to 70m. The remaining area of the shelf and upper horizons of the slope are occupied by boreal fauna. Low-arctic complex is characterized by Macoma calcarea and Ophiura sarsi, while the boreal one is characterized by Echinarachnius parma and Yoldia traciaeformis. Author (TAB)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N70-11410*# Ohio State Univ. Research Foundation, Columbus.
INFRARED TEMPERATURE SOUNDING: S-043 Final Report, 1 Jul. 1967 - 31 Aug. 1969
J. H. Shaw, M. T. Chanine (JPL), A. R. Eisenman (JPL), C. B. Farmer (JPL), L. D. Kaplan (JPL) et al Sep. 1969 153 p refs
(Contract NAS9-7218; RF Proj. 2469)
(NASA-CR-102004; Rept-20) Avail: CFSTI CSCL 14B

A balloon-borne multidetector grating spectrometer was developed to measure the earth's spectral radiance near 4.3 microns. The optics, radiometric components, and the electronics are discussed. An engineering model was built, and descriptions are given of its timing sequences and logic design, exposure time, error due to linear quantization, data channel electronics, and multiplexer. The spectrometer takes measurements in 35 spectral intervals about 0.04 microns wide at 20 sec intervals with a resolving power of 100. The spectrometer calibration is described, and balloon flight tests were considered to demonstrate its performance capability. A highly convergent relaxation method is presented for the inversion of the full radiative transfer equation and the determination of the atmospheric temperature profile from the outgoing radiance. The problems of uniqueness and stability associated with the relaxation method are discussed, and inverse problems are formulated for determining the concentration of absorbing gases, the extent and height of clouds, and surface elevations. Nighttime and daytime surface temperatures and daytime cloud top temperatures were obtained, along with outgoing radiance measurements during a sunrise. N.E.N.

N70-11490# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div
ELECTRONIC INSTRUMENTATION OF A 10,000-PSIG UNDERWATER SOUND TRANSDUCER CALIBRATION FACILITY FOR THE 10- TO 4000-Hz FREQUENCY RANGE
Robert E. Ford and Lynn P. Browder 15 Aug. 1969 16 p refs
(AD-693096; NRL-6986) Avail: CFSTI CSCL 20/1

The electronic instrumentation of a new measuring facility for calibrating underwater sound transducers at controlled temperature from 3 to 45C in the frequency range 10 to 4000 Hz at hydrostatic pressure to 10,000 psig is described. The pressure vessel consists of a vertically mounted 20.3-cm-i.d. stainless-steel tube 274.3 cm long. An active-impedance termination can be established at one or both ends of the tube to provide a plane, progressive wave within it. Three phase- and amplitude-adjustable outputs from the signal source activate the source transducer and those that control the terminal impedance. Multiple probe transducers and receiving channels serve to establish and monitor the required wave condition. Delay lines enable rapid and convenient adjustment to obtain minimum standing-wave ratio. Author (TAB)

N70-11514# Army Foreign Science and Technology Center, Washington, D.C.
ONE METHOD OF AUTOMATIC COMPENSATION FOR THE INFLUENCE OF DIELECTRIC LOSSES DURING THE MEASUREMENT OF THE MOISTURE CONTENT OF MATERIALS IN AN ALTERNATING FIELD
V. S. Roife 26 Aug. 1969 14 p refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 5, 1967 p 57 - 58
(AD-693243; FSTC-HT-23-295-69) Avail: CFSTI CSCL 14/2

The report describes an improved electronic device for measuring the moisture content of structural materials, regardless of the chemical composition or salt content of the materials involved. An automatic compensation circuit based on a varicap is provided which balances losses in the sensing device. Schematic diagrams and graphs showing the results of laboratory tests are also included. TAB

N70-11519# Northeastern Univ., Boston, Mass.
ON THE DESIGN OF AN INSTRUMENT TO USE FORWARD SCATTERED LIGHT TO DETECT SMALL PARTICLES Final Report, 1 Jan. 1968 - 31 Mar. 1969
John F. Dunn, Jr., Arthur R. Foster, Don A. Lautman, Louis J. Nardone, John L. Swanson et al 15 Aug. 1969 33 p
(Contract F19628-67-C-0187)
(AD-693557; AFCRL-69-0334) Avail: CFSTI CSCL 20/6

The response of an instrument using forward scattered light to detect small particles is studied. The parameters considered include the size and optical properties of the particle, the speed of the particle relative to the instrument, the spectral intensity of the light source, the spectral quantum efficiency of the photosensitive detector, and those of the light collecting arrangement. Author (TAB)

N70-11530# Greyrad Corp., Princeton, N.J.
TURBINE FLOWMETER PERFORMANCE MODEL Final Report

Richard E. Thompson and Jerry Grey. 15 Apr. 1969. 11 p. refs
(Contract DAAH01-67-C-1609)
(AD-693357; AMC-3) Avail: CFSTI CSCL 21/9

The purpose of this addendum is to incorporate additional turbine flowmeter test case information that may be of interest to the user of the computer program, and also to include several minor corrections in the questionnaire. Author (TAB)

N70-11568# Boeing Co., Seattle, Wash. System Development Corp., Falls Church, Va.
CHANGE DETECTION IN AERIAL PHOTO COVERAGE AS INFLUENCED BY METHODS OF COMPARISON
C. L. Klingberg, C. L. Elworth, and S. Epstein. Jan. 1969. 43 p. refs. Prepared in cooperation with System Develop. Corp.
(Contracts DA-49-092-ARO-92; DA-2-Q-662704-A-721)
(AD-692844; TRN-205) Avail: CFSTI CSCL 14/5

A study was made to investigate the effects of selected variations in procedure--methods of comparing current with prior imagery cover, familiarity of the interpreter with the area, and time allowed for interpretation--on the completeness and accuracy with which change in the status of targets is detected. Under the 5-minute time limit, the computer comparison of independent interpretations of current and prior photo coverage resulted in more complete change detection than did the other methods employed and about the same degree of accuracy. The advantage of computer comparison was less marked under the 15-minute time limit. Providing the interpreter with overlay plus a written report on the prior imagery was the least effective of the comparison methods investigated. Without the actual imagery from the earlier mission, the interpreter has no way of correcting errors in the earlier interpretation. The method also was time-consuming. Interpreter familiarity with the terrain through preparation of reports on the prior imagery resulted in more complete and more accurate change detection under the 5-minute time limit. Under the 15-minute time limit, the advantage was negligible. Author (TAB)

N70-11578# Army Foreign Science and Technology Center, Washington, D.C.
A PRECISION MEASURING DEVICE FOR TIME INTERVALS USING MULTISTABLE ELEMENTS
S. V. Dennovetskii et al. 26 Aug. 1969. 9 p. refs. Transl. into ENGLISH from the Russian
(AD-693231; FSTC-HT-23-367-69) Avail: CFSTI CSCL 14/2

The use of multistable elements for sequential counting time interval measurement is promising if sampling errors can be reduced. A significant improvement in accuracy can be obtained by using a scale-time conversion of the interval between the start and first digitizing impulse and the interval between the last digitizing impulse and the stop impulse. Thus, no reduction in impulse period and no increase in counter stop requirement is needed. TAB

N70-11589# Army Foreign Science and Technology Center, Washington, D.C.
TURBINE DISK TEST BAND
V. A. Sekistov et al. 18 Aug. 1969. 9 p. Transl. into ENGLISH from Russian Patent No. 209815 (Appl. 26 Dec. 1966)
(AD-693066; FSTC-HT-23-334-69) Avail: CFSTI CSCL 14/2

A device for testing of turbine disks under conditions of thermal cycling, which contains apparatus for heating the periphery of the disk and cooling its central part is distinguished by the fact that with the purpose of approximating test conditions to work conditions of a turbine disk, the device for heating is made in the form of a circular combustion chamber, and the device for cooling in the form of chambers with grids placed along both sides of the disk, which have concentric circular openings located along the radii for inlet of cooling agent, which are overlapped by circular washers for the regulation of the size of the grid. Author (TAB)

N70-11638# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NOISE GENERATOR
16 Jul. 1969. 4 p. Transl. into ENGLISH from Wu Hsien Tien Chi Shu (Mainland China) no. 6, 1966 p. 47
(AD-693528; FTD-HT-23-1144-68) Avail: CFSTI CSCL 14/2

The subject noise generator is capable of accurately measuring internal noises in highly sensitive receiving and amplifying equipments within rated frequency ranges, and is suitable as a noise source to supply a standard noise power output. Author (TAB)

N70-11658# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GAGES FOR MEASURING DEFORMATION OF HIGHLY ELASTIC MATERIALS
A. B. Ayvazov. 4 Jun. 1969. 8 p. Transl. into ENGLISH of the publ. "Rezina-Konstruktsionnyy Material Sovremennogo Mashinostroeniya" Moscow, 1967 p. 256-258
(AD-693270; FTD-MT-24-119-69) Avail: CFSTI CSCL 14/2

Two types of gages for measuring tensile, flexural, and torsional strain are discussed. The contact gage is designed for measuring static and dynamic deformations of polymers, for which it has accuracies of 20 millimicrons and 50 millimicrons, respectively, on a base of up to 75 mm. Its operating temperature range is 20-200C. The inductive gage is designed for measuring and recording static and slowly varying dynamic deformations. It has a minimum measurement and recording range of 1 mm for accuracy of 0.01 mm. Its advantages are simplicity, 50-Hz power, and linear response. Author (TAB)

N70-11695# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STEREOPHOTOGRAMMETRIC INSTRUMENT
G. V. Lazarev. 1 Jul. 1969. 4 p. Transl. into ENGLISH from Russian Patent No. 174378 (Appl. No. 872278/26-10, 24 Dec. 1963) 2 p
(AD-693592; FTD-HT-23-202-68) Avail: CFSTI CSCL 8/2

The authors certificate introduces a stereophotogrammetric instrument which contains a fixed base with an optical system, a movable carriage with photograph holders, and a computer for correcting the coordinates of points on aerial photographs. Measurement accuracy is improved and the speed of the instrument is increased by using computer components, e.g. multipliers, in the form of bellows units filled with a liquid and kinematically coupled to the correction rulers and the photograph holders. Author (TAB)

N70-11747# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN RC SWEEP FREQUENCY DEVICE
Feng-Heng Li. 6 Jun. 1969. 8 p. Transl. into ENGLISH from Wu Hsien Tien Chi Shu (Mainland China), no. 2, 1966 p. 15-18
(AD-693513; FTD-23-33-69) Avail: CFSTI CSCL 14/2

An RC sweep frequency device is introduced which is low in cost and simple in circuitry, with quality indices comparable to those of an LC sweep frequency device. When combined with an ordinary oscilloscope, it is suitable for observing the frequency-response characteristic of bandpass filters or bandpass amplifiers. Design of a sweep generator is analyzed. Quality indices of a sweep frequency device built by ourselves are given in the conclusion. Author (TAB)

N70-11873# Los Alamos Scientific Lab., N.Mex.
TEST OF COMBUSTION-PRODUCT DETECTORS IN A RADIATION ENVIRONMENT
Thomas M. Putnam and Joseph R. Parker. Mar. 1969. 12 p. refs
(Contract W-7405-eng-36)
(LA-4148-MS) Avail: CFSTI

Ionization type combustion product detectors proposed for early warning fire detectors at the Los Alamos Meson Physics Facility (LAMPF) were tested for response to an electrical fire in an accelerator produced radiation environment. Three each of six different models were tested. The results show that this type of detector will not work in this environment. Author (NSA)

N70-11897# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TESTS AND CALIBRATION OF THE STATIC ELECTRIC RESISTANCE STRAIN GAGE
Sheng-an Ts'ao 17 Jun. 1969 28 p ref Transl. into ENGLISH from Chi Liang Chi Shu Yu i Ch'i Chih Tsao (Mainland China), v. 2, no. 3, 1964 p 34-41
(AD-693418; FTD-HT-23-914-68) Avail: CFSTI CSCL 14/2

This article points out problems existing in the techniques of authenticating an electric resistance strain gage. After a brief explanation of technical requirements of the electric resistance strain gage in static strain measurements, the test and calibration methods of the double-bridge zero-reading type electric resistance strain gage are introduced. Gage calibration includes three parts, namely, structural inspections, operating performance tests, and calibration. The special feature of the proposed method is that the standard delta R/R used in the calibration is not the resistance change produced by strains in resistance strain strips, but is produced by an electric method; therefore, accuracy is high. Design and construction data for a strain gage calibrator are also given. The calibration methods and calibrator proposed have been proved to have high accuracy by practical application and guarantee that electric resistance strain gage error after calibration will be less than plus or minus 1%. Author (TAB)

N70-11992# Douglas United Nuclear, Inc., Richland, Wash.
CIRCUIT CONCEPTS CONSIDERED IN DEVELOPMENT OF A POCKET DOSIMETER
G. L. Erickson 20 Jun. 1969 8 p refs
(Contract AT(45-1)-1857)
(DUN-5936) Avail: CFSTI

Various concepts of dose integration circuits in the development of an integrating-type pocket dosimeter using a Geiger-Mueller tube are presented. These include capacitor integration, mechanical integration, and electro-chemical integration. NSA

N70-12003# National Bureau of Standards, Boulder, Colo.
MAKING VALUABLE MEASUREMENTS: PROCEEDINGS OF THE 1968 STANDARDS LABORATORY CONFERENCE
H. L. Mason ed. May 1969 176 p refs Conf. held at Boulder, Colo., 26-29 Aug. 1968
(NBS-SP-313) Avail: CFSTI

CONTENTS:

1. MEASUREMENTS FOR SOCIETY J. L. Sloop (NASA, Washington, D.C.) p 5-7 refs (See N70-12004 02-14)
2. SESSION 1: DOD ACTIVITIES p 9-17 refs (See N70-12005 02-14)
3. SESSION 2: NCSL LIAISON DELEGATE REPORTS p 19-26 refs (See N70-12006 02-14)
4. SESSION 3: NBS ACTIVITIES p 27-50 refs (See N70-12007 02-14)
5. SESSION 4: INTERNATIONAL MEASUREMENTS p 51-86 refs (See N70-12008 02-14)
6. SESSION 5: NCSL COMMITTEE REPORTS p 87-102 refs (See N70-12009 02-14)
7. SESSION 6: THE VALUE OF MEASUREMENT AGREEMENT COMPARISON p 103-124 refs (See N70-12010 02-14)
8. SESSION 7: THE MANAGEMENT OF EQUIPMENT AND DATA p 125-160 refs (See N70-12011 02-14)
9. SESSION 8: THE MANAGEMENT OF VALUABLE MEASUREMENTS p 161-177 refs (See N70-12012 02-14)

N70-12004*# National Aeronautics and Space Administration, Washington, D.C.
MEASUREMENTS FOR SOCIETY
John L. Sloop *In* NBS Making Valuable Meas.: Proc. of the 1968 Std. Lab. Conf. May 1969 p 5-7 refs (See N70-12003 02-14)
Avail: CFSTI CSCL 14B

Recent ideas for new measurements and the need for more accurate measurements are pointed out and the role of science and technology impact as a yardstick for measuring our society is put in focus. The direct link between a capability of innovation, education, management, and economic growth is established. Benefits of space technology for the society include the following economic developments: (1) satellite communication network; (2) world-wide meteorological network; (3) scientific satellite measurements of earth and space environment; (4) lunar photographs by orbiting spacecraft and from manned lunar landings; (5) observations of Venus and Mars environments by space probes; (6) Mercury and Gemini manned space flights; and (7) growth technology as foundation for future space missions and applications to earth. G.G.

N70-12005# National Bureau of Standards, Boulder, Colo.
SESSION 1: DOD ACTIVITIES
In its Making Valuable Meas.: Proc. of the 1968 Std. Lab. Conf. May 1969 p 9-17 refs (See N70-12003 02-14)
Avail: CFSTI

The Department of Defense Calibration Coordination Group is established to provide coordination and cooperation among the three services in their calibration and metrology programs and in their relations with the National Bureau of Standards. Author

N70-12006# National Bureau of Standards, Boulder, Colo.
SESSION 2: NCSL LIASON DELEGATE REPORTS
In its Making Valuable Meas.: Proc. of the 1968 Std. Lab. Conf. May 1969 p 19-26 refs (See N70-12003 02-14)
Avail: CFSTI

This important organization is active in promoting technical sessions and symposia, in publishing papers describing technical developments, and in preparing standards of practice and performance in its field of interest. This is done through its six very active technical committees, which cover the measurement of frequency and time and of electrical quantities from dc through microwave frequencies. Author

N70-12007# National Bureau of Standards, Boulder, Colo.
SESSION 3: NBS ACTIVITIES
In its Making Valuable Meas.: Proc. of the 1968 Std. Lab. Conf. May 1969 p 27-50 refs (See N70-12003 02-14)
Avail: CFSTI

Concepts of economic value are defined and their usefulness in determining the economic value of measurement data are indicated. Resources in the National Measurement System and various classes of users are described to provide a context for examining economic value. The role of measurement data in decision-making is suggested and the economic consequences of decisions are indicated. The effect on economic value of alternative measurement sources and reliability is described. Economic value (benefits) and cost are distinguished. The application of these concepts is illustrated using results of case studies of measurement projects. Author

N70-12008# National Bureau of Standards, Boulder, Colo.
SESSION 4: INTERNATIONAL MEASUREMENTS
In its Making Valuable Meas.: Proc. of the 1968 Std. Lab. Conf. May 1969 p 51-86 refs (See N70-12003 02-14)
Avail: CFSTI

Technical, financial, institutional, and governmental resources are outlined for the interagency effort to establish metric standard units in the United States of America. One of the most difficult tasks is to define the dollar values involved in the employment of standard metric units for international trade and balance of payments. It is concluded that controlled measurements are a necessity to permit coordinated exchange of industrial products with other nations. G.G.

N70-12009# National Bureau of Standards, Boulder, Colo.
SESSION 5: NCSL COMMITTEE REPORTS

In its Making Valuable Meas. : Proc. of the 1968 Std. Lab. Conf. May 1969 p 87–102 refs (See N70-12003 02-14)
Avail: CFSTI

Committee activities during the last 18 months embraced the following four subjects: (1) analysis and interpretation of a questionnaire to determine information needs; (2) panel discussion on measurement standards instrumentation; (3) preparation and publication of bibliography on measurement statistics; and (4) information retrieval problems of standard laboratories. Results from the questionnaire showed that specific calibration procedures obtained the most weighted response points. G.G.

N70-12010# National Bureau of Standards, Boulder, Colo.
SESSION 6: THE VALUE OF MEASUREMENT AGREEMENT COMPARISON
In its Making Valuable Meas. : Proc. of the 1968 Std. Lab. Conf. May 1969 p 103–124 refs (See N70-12003 02-14)
Avail: CFSTI

Preliminary results are presented for an international comparison of power standards at 3 GHz. Other participants included Japan, U.S.S.R., and Canada, each of which furnished transfer standards for use in the intercomparison. A fifth laboratory, German Office for Metrology and Product Testing also participated to the extent of making measurements on transfer standards submitted by others. Measurement results obtained at each laboratory were sent to the International Bureau of Weights and Measures which sponsored the intercomparison and will issue the final report summarizing the results. Author

N70-12011# National Bureau of Standards, Boulder, Colo.
SESSION 7: THE MANAGEMENT OF EQUIPMENT AND DATA
In its Making Valuable Meas. Proc. of the 1968 Std. Lab. Conf. May 1969 p 125–160 refs (See N70-12003 02-14)
Avail: CFSTI

The radio standards and measurements information center is being established to help solve measurement problems by collecting, analyzing, and disseminating measurement know-how applicable to standards and measurement techniques from 30 kHz through the millimeter-wave frequencies. The objectives, services, and techniques of the center are described. Feedback is solicited as to the kind of information and services likely to be most useful. Author

N70-12012# National Bureau of Standards, Boulder, Colo.
SESSION 8: THE MANAGEMENT OF VALUABLE MEASUREMENTS
In its Making Valuable Meas. Proc. of the 1968 Std. Lab. Conf. May 1969 p 161–177 refs (See N70-12003 02-14)
Avail: CFSTI

The control of measurement tools and equipment is vital to any industrial process and project management is required to plan measurements tasks in all phases of the product life cycle by careful selection and clear specifications of such tasks. An outline for a management control program is given that contains the following nine major elements: (1) planning; (2) administration; (3) maintenance of standards; (4) calibration and maintenance of test and measuring equipment; (5) test equipment distribution and utilization; (6) use data on test equipment; (7) training of user personnel; (8) audit of measurement control program; and (9) acquisition and disposal of test equipment. G.G.

N70-12094# Los Alamos Scientific Lab., N.Mex.
RECENT ADVANCES IN FAST-RESPONSE MINIATURE NEUTRON FLUX MONITORS
D. B. Stillman and R. L. Chaney 4 Mar. 1969 12 p refs
(Contract W-7405-eng-36)
(LA-4126) Avail: CFSTI

A fast response miniature neutron detector has been developed to measure temperature-time history of fissile materials under intense neutron irradiation. The fissile-sensing element of the fission couple neutron detector is approximately 0.030 in. in diameter. The detector sensitivity for thermal neutrons is approximately 10 to the 9th power n/sq cm deg C. To determine any limitations in response time, fission couples were placed 3 m from a nuclear device in an underground nuclear weapons test at the Nevada Test Site. The detector accurately followed the change in neutron population (alpha measurement) as the device exploded. This rapid change in neutron population had an e-folding time of 20 nsec. The miniature size and fast response of a fission couple combine to offer unique advantages as a new tool in reactor diagnostics and control. Author (NSA)

N70-12097# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
STUDY OF THE EFFECT OF POSITIVE IONS IMPINGING ON SENSITIVE EMULSIONS IN MASS SPECTROGRAPHY [ETUDE DE L'ACTION DES IONS POSITIFS SUR LES EMULSIONS SENSIBLES EN SPECTROGRAPHIE DE MASSE]
André Cavard (Ph.D. Thesis) Aug. 1969 113 p refs In FRENCH; ENGLISH summary
(CEA-R-3759) Avail: CFSTI

Experimental relationships have been established between the blackening of emulsions by impinging ions and the following parameters: number, mass and energy of impinging particles. Mean energy ions (about twenty keV) give rise to a latent image probably made of small specks of metallic silver located at the surface or in the bulk of the silver halide grain. A specific developer for ion sensitive emulsion was perfected. Sensitivity and detection threshold are increased by a factor of two or three compared with values observed using a classical developer. Low energy particles sputtered from superficial layers of the emulsion by the impinging twenty keV ions, produce a latent image close to the surface of the silver halide grain. An oxidizing process bleaches the superficial latent image and then reduces background fog. The improved signal over background ratio allows to observe lines undetectable when the plates are developed by usual process. Author (ESRO)

N70-12148# Stanford Univ., Calif. High Energy Physics Lab.
X-RAY DETECTION IN SEMICONDUCTORS AND SCINTILLATORS Final Report
Donald W. Aitken 1 Jan. 1969 10 p refs
(Contract AF 49(638)-1499)
(AD-692890; AFOSR-69-1867-TR) Avail: CFSTI CSCL 18/4

The broad objectives of the program were to investigate alkali-halide scintillators and silicon and germanium radiation detectors with x rays and charged particles, to determine intrinsic physical properties while also leading to new practical applications of these devices in the low energy x-ray region. The report summarizes the work actually performed and the new directions and applications that resulted from the work, and concludes that the objectives of the originally proposed research were satisfactorily accomplished. TAB

N70-12163# Institute of Physical and Chemical Research, Saitama (Japan).
RADIOCHEMISTRY
In its IPCR Cyclotron, Vol. 2 1968 p 121–133 refs (See N70-12156 02-24)
Avail: CFSTI

Results of continuing work on charged particle activation analysis for carbon, nitrogen, and oxygen reactions in semiconducting silicon are tabulated. Data derived from a study of the behavior of radioactive, recoil iodine atoms arising from (n,gamma) and (n,2n) reactions in solid iodates are also presented as part of a systematic investigation of the chemical effects of nuclear processes in halates. Preparation of a Cu-61–copper source for measuring the Mossbauer effect in Ni-61 is described, and it is reported that measurements of the spectra of various nickel compounds are in progress. Finally, a new technique of radioactive reaction labeling was investigated by bombarding accelerated proton particles onto a mixture of C-14 and an organic compound. A.C.R.

N70-12213# Army Weapons Command, Rock Island, Ill. Science and Technology Lab.

HOLOGRAPHIC INTERFEROMETRY: TECHNIQUES AND APPLICATIONS

R. J. Iverson and J. W. Mc Garvey Jun. 1969 29 p refs

(AD-691131; RIA-69-116) Avail: CFSTI CSCL 14/5

Three applications of holographic interferometry are presented which are useful as design and inspection techniques for a wide variety of military hardware. Voids as small as one-quarter inch in diameter were detected in rubber-to-metal bonds by use of a heat-stressing technique. The contour and the amplitude of complex, acoustically excited vibrations of a metal panel and a cast iron cylinder, were also analyzed. In addition, the holographically measured deflection of a cantilever beam was compared with the theoretically predicted deflection. Author (TAB)

N70-12253# Commissariat à l'Energie Atomique, Saclay (France).

THE n,GAMMA DISCRIMINATION IN RECOIL PROTON PROPORTIONAL COUNTERS. APPLICATION TO THE MEASUREMENT OF FAST NEUTRON SPECTRA [DISCRIMINATION n,GAMMA DANS LES COMPTEURS PROPORTIONNELS A PROTONS DE RECUL. APPLICATION A LA MESURE DES SPECTRES DE NEUTRONS RAPIDES]

Claude Jeandidier (Ph.D. Thesis--Paris Univ.) Jun. 1969 77 p refs In FRENCH; ENGLISH summary

(CEA-R-3823) Avail: CFSTI

A description is given of a spectrometry chain working in the energy range of a few keV to 1 MeV, and designed for measurement of fast neutron spectra. It consists of detectors, recoil proton proportional counters built especially for this work by R. Comte which make it possible to cover the energy range, and also associated electronic equipment. A brief description is given of the physical processes involved: (n,p) collisions in the gas, influence of gamma radiation and the method of discrimination is then presented which is based on the difference in the rise-times of the pulses. In the experiments described the use of a bi-parametric system made it possible to employ the most simple discrimination device, based on the fact that the high frequency gamma pulse components are, at a given energy, weaker than those of the neutron pulses. Results are given of measurements carried out on the Van de Graaff (mono-energetic neutrons for testing the linearity of the chain and the resolving power of the counters), and those made in a sub-critical system HUG at Cadarache. Author (ESRO)

N70-12267# National Physical Lab., Teddington (England). Div. of Inorganic and Metallic Structure.

SOME APPLICATIONS OF HIGH VOLTAGE ELECTRON MICROSCOPY

K. F. Hale and M. Henderson Brown Sep. 1969 27 p refs

(NPL-IMS-4) Avail: CFSTI

Methods of determining penetration curves are described and the curves given for iron, tungsten, cement and glass. The gain in penetration compared with 100 kV is about 3:1 at 500 kV and between 5 and 6:1 at 1 MV. The extra penetration will allow many investigations at high accelerating voltages which would otherwise be difficult or even impossible by 100 kV electron microscopy, and examples are given for both metals and non-metals. Author (ESRO)

N70-12276# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div.

UNDERWATER SOUND TRANSDUCER CALIBRATION FACILITY FOR THE 10 TO 4000-Hz FREQUENCY RANGE AT HYDROSTATIC PRESSURE TO 10 Interim Report

Louis G. Beatty and Joseph F. Prandoni 15 Aug. 1969 20 p refs

(AD-693091; NRL-6965) Avail: CFSTI CSCL 20/1

A new controlled-environment facility operating on the principle of active-impedance termination in a rigid-walled tube now provides the means of calibrating a wide variety of underwater sound transducers in the increasingly important frequency range 10 to 4000 Hz at static pressure to 10,000 psig and temperature from 3 to 45 C. This report describes the theory, limitations, and mechanical features of the facility and presents examples of both primary and secondary calibrations of transducers in the tube and in a free field. Author (TAB)

N70-12298# Argonne Cancer Research Hospital, Chicago, Ill.

OPTICAL PROCESSING OF RADIONUCLIDE IMAGES

Robert N. Beck, Donald B. Charleston, Paul V. Harper, and Nicholas J. Yasillo May 1969 21 p refs Presented at the 7th Natl. Biomedical Sci. Instr. Symp.

(Contract AT(11-1)-69)

(ACRH-1000-130; CONF-690520-1) Avail: CFSTI

The quality of radionuclide images is limited by the spatial resolution of the collimated radiation detector, noise due to random fluctuations in the signal level, and line structure due to the rectilinear scanning motion of the detector. Within the limits of a useful signal-to-noise ratio, such images can be altered in various ways by optical spatial filtering techniques. Sharpening is accomplished by removing the low spatial frequency components from the image, which (relatively) enhances the high frequency components. Smoothing of recorded noise is accomplished by removing the high frequency components that lie above the detector bandpass. Line structure is removed by a special filter that blocks the periodic pattern which characterizes the scan raster. In this pilot study, an inexpensive HeNe laser and simple lenses comprise the optical system. Author (NSA)

N70-12311*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A PERFORMANCE ANALYSIS OF THE OPTICAL-MECHANICAL SCANNER AS AN IMAGING SYSTEM FOR PLANETARY LANDERS

Friedrich O. Huck and Jules J. Lambiotte, Jr. Washington Dec. 1969 42 p refs

(NASA-TN-D-5552) Avail: CFSTI CSCL 14B

The performance parameters considered are signal-to-noise ratio, angular scanning resolution, tolerance for defect of focus, and video acquisition rate. Results show how these parameters are interrelated and what trade-offs must be made for a specific mission. A model of the Martian environment used for the preliminary design of the Viking lander is considered. Author

N70-12345# Krupp (Fried.) G.m.b.H., Essen (West Germany). Zentralinstitut fuer Forschung und Entwicklung.

AUTOMATIC X-RAY MICROSTRUCTURE ANALYSIS [AUTOMATISCHE ROENTGENFEINSTRUKTURANALYSE]

J. Willbrand *In its* Krupp Tech. Inform. Res. Rept., Vol. 27, No. 1 May 1969 p 11-12 In GERMAN; ENGLISH summary (See N70-12343 02-34)

Avail: CFSTI

Development and operation of a program controlled sample changer to be used with the Philips vertical goniometer. The device can be used to analyse powder and compact samples. Author (ESRO)

N70-12363# Krupp (Fried.) G.m.b.H., Essen (West Germany). Zentralinst. für Forschung und Entwicklung.

KRUPP'S NEW AIR CONDITIONING UNIT [DAS NEUE KRUPP-KLIMAGERAET]

H. Ufer and E. Kriegel *In its* Krupp Tech. Inform. Eng. Rept., Vol. 27, No. 2 Jun. 1969 p 69-76 In GERMAN; ENGLISH summary (See N70-12351 02-34)

Avail: CFSTI

The mechanical and thermodynamical design of low pressure air conditioning equipment is described and the advantages of the blower used are outlined. Special attention is given to noise reduction. Author (ESRO)

N70-12368# Argonne National Lab., Ill.

DETECTION OF TRANSIENTS IN NUCLEAR SURVEILLANCE-COUNTING CHANNELS

K. G. Porges Nov. 1968 97 p refs
(Contract W-31-109-eng-38)
(ANL-7470) Avail: CFSTI

A number of transient detection systems are reviewed and one particular application, fuel failure monitoring in connection with high power density reactor cores is described in detail. The instrument generally incorporates a filter which must be arranged to optimize the display of the transient; or to result in a specified detection efficiency and acceptable false alarm frequency, in conjunction with an acceptable announcement delay. The design of such a filter is discussed and formulas are given for estimating the false alarm frequency at a specified detection efficiency. In connection with the optimum filtering problem, the beneficial effect of pulse shape symmetrization is considered in detail. A simple digital channel is described which should provide improved performance parameters with considerably better long-term reliability than conventional analog equipment. Author (NSA)

N70-12364# Royal Aircraft Establishment, Farnborough (England). Instruments and Electrical Engineering Dept.
PERFORMANCE CHARACTERISTICS AND METHODS OF TESTING OF FORCE-FEEDBACK ACCELEROMETERS
I. L. Thomas and R. H. Evans 1969 53 p refs Supersedes RAE-TR-67183
(ARC-R/M-3601; ARE-TR-67183) Avail: HMSO £ 1 7s 6d; BIS $4.95 BIS $4.95

The more important parameters of force-feedback accelerometers are defined, sources of error are discussed and an outline is given of methods by which the accelerometers may be evaluated and calibrated. The emphasis is on treating the accelerometer as a self-contained component rather than as part of a navigation or other system. It is hoped that sufficient information on static and dynamic performance is included to be of value to a wide capacity. Author (ESRO)

N70-12393*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FLOWMETER FOR SPACE
T. F. Morris Washington Dec. 1969 27 p
(NASA-TN-D-5517; M-651) Avail: CFSTI CSCL 14B

This report discusses the development of a mass flowmeter designed for use in outer space. The purpose of the flowmeter is to measure flowrates from purges and collected leaks at leak ports, on aerospace hardware, discharging into a space environment. One of the most notable features of the flowmeter is the capability to measure the flow of all common gases such as hydrogen, helium, nitrogen, oxygen, and organic vapors. These gases can be measured over a wide range of flowrates (nitrogen, 5 sccm to 2500 sccm) in a space environment of zero-gravity to extremely low pressures, and with temperature extremes of 70 to 500 K. Author

N70-12395*# California Inst. of Tech., Pasadena. Seismological Lab.
DEVELOPMENT OF PERFORMANCE CRITERIA AND FUNCTIONAL SPECIFICATIONS FOR A PASSIVE SEISMIC EXPERIMENT ON MARS Progress Report, 15 May 1969 - 31 Aug. 1969
Don L. Anderson 31 Aug. 1969 13 p
(Grant NGR-05-002-129)
(NASA-CR-107101) Avail: CFSTI CSCL 14B

Design changes and tests of the seismometer, the seismic data processor, and the seismic event trigger to be used in the Viking Program are reported. Methods of data compression were required which will allow reasonable recovery of the wideband data while sampling at a moderate rate of one sample per second during times that the event detector signals the presence of a seismic event. Efforts included reduction of the weight and volume, and caging of the three unit seismometer package for vibration and shock survival; assembling of the preamplifiers, amplifiers, filters, averaging circuits, and the event trigger on circuit boards; testing of the breadboard trigger; and the analysis of a feasible data compression scheme. M.H.E.

N70-12409# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
EVALUATION OF A METAL LAMELLAR GRATING FOR THE AEROSPACE INTERFEROMETER
J. M. Dowling, C. M. Randall, and T. E. Mott 15 Jul. 1969 22 p refs
(Contract F04701-69-C-0068)
(AD-693128; TR-0066(9260-01)-5; TR-0200(9260-01)-10; SAMSO-TR-69-275) Avail: CFSTI CSCL 20/6

In the 6-month period between September 1967 and March 1968 the sensitivity of the lamellar grating interferometer deteriorated significantly in the short wavelength region (~ 80 micrometer). The cause of the degradation in performance was traced to a deterioration of the optical quality of the stationary element of the pyrex glass lamellar grating. A prototype metal lamellar grating has been designed and fabricated. It was monitored for stability over a 45-day period. It is concluded that the improved design and less fragile nature of a metal lamellar grating compared to a glass one leads to a more stable grating. Author (TAB)

N70-12443# Naval Postgraduate School, Monterey, Calif.
A VIBRATING-REED MASS-FLOW-METER
Clifford Larry Jamerson (M.S. Thesis) Jun. 1969 38 p ref
(AD-693100) Avail: CFSTI CSCL 14/2

For many fluid-mass-rate-of-flow metering situations, a measure of the fluid's density-velocity product is required. The density-velocity PV product is multiplied by an effective conduit cross-sectional area to yield the mass-rate-of-flow. The area multiplication is accomplished by simply changing the scale of the PV-product indicator. The purpose of this paper is to show how a magnetically-driven vibrating reed can be used to measure either the PV product of a fluid or its mass-rate-of-flow through a conduit. The proposed meter differs from the rotating-vane mass-rate-of-flow meters in that it operates on a transverse rather than angular momentum exchange. Author (TAB)

N70-12445# Cosmic, Inc., Gaithersburg, Md.
INVESTIGATION OF CURRENT VOLTAGE CHARACTERISTICS OF SPACECRAFT MOUNTED SPHERICAL ELECTROSTATIC ANALYZERS Final Report, 11 Mar. 1968 - 10 May 1969
Patrick A. Crowley and Kenneth H. Carpenter 10 Jun. 1969 39 p refs
(Contract F19628-68-C-0302)
(AD-693208; AFCRL-69-0331) Avail: CFSTI CSCL 4/1

The current/voltage characteristic of a spherical probe with an assumed spherical potential distribution has been used to analyze data taken by probes mounted on sounding rockets. A computer program which performs least squares fits of this data to the current/voltage characteristic has been written. Major difficulties encountered in this work seem to be related primarily to the carrying craft size relative to the probe. Attempts to account for periodic variations in the current at constant voltage and efforts made to consider this effect in the analysis of the data are summarized. Author (TAB)

N70-12501# Battelle-Northwest, Richland, Wash. Nondestructive Testing Dept.
ULTRASONIC THICKNESS MEASUREMENT FOR PRECISION CONTROL OF MACHINE TOOLS
Dennis R. Newman and Lloyd T. Lamb Jul. 1969 23 p refs
(Contract AT(45-1)-1830)
(BNWL-1022) Avail: CFSTI

A prototype ultrasonic micrometer using the pulse interference technique has been developed which gives an accurate, continuous readout. The micrometer has been adapted for control of an electro-spark discharge machine and the system has been used to mill aluminum plates to within + or - 0.0001 inch of a constant

thickness. Physical principles and electronic circuits for the system are described. Author (NSA)

N70-12618*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THIN-FILM GAUGE Patent Application
Angus G. Mc Ronald, inventor (to NASA) Filed 29 May 1969 14 p
(Contract NAS7-100)
(NASA-Case-NPO-10617; US-Patent-Appl-SN-828920) Avail: CFSTI CSCL 14B

Proposed are temperature measuring gauges to be employed in obtaining measurements of distributed, convective heat transfer rates on possible planetary entry and earth re-entry shapes. By employing the concept of painting metallic leads on a thin-film substrate for conducting a constant current through a thermally active area and picking off the voltage drop induced at the thermally active area, resolution in measurements in heat transfer is enhanced, and perturbation of the flow of air across the surface is reduced for thereby enhancing gauge accuracy. NASA

N70-12626*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
METHOD AND APPARATUS FOR THE DETECTION OF PICOSECOND LIGHT PULSES BY TWO-PHOTON PLANAR PROCESSES Patent Application
David C. Burnham and Kenneth W. Billman, inventors (to NASA). Filed 28 Aug. 1969 16 p
(NASA-Case-ERC-10227; US-Patent-Appl-SN-853724) Avail: CFSTI CSCL 14B

Apparatus and techniques for detecting and measuring picosecond light pulses are disclosed. Two plane light beams from a mode-locked neodymium glass laser are directed onto a photographic plate or the photocathode of an image orthicon in such a manner that the pulses overlap. The intensity overlap between the two light beams is measured by two-photon excitation of the photographic plate in a first pair of embodiments of the invention, and by the two-photon excitation of the photocathode of an image orthicon in a second pair of embodiments of the invention. The invention can be used to measure the properties of the picosecond laser pulses. NASA

N70-12640*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
MULTIPLE HOLOGRAM RECORDING AND READ OUT SYSTEM Patent Application
James N. Hallock, inventor (to NASA) Filed 28 Aug. 1969
(NASA-Case-ERC-10151; US-Patent-Appl-SN-853856) Avail: CFSTI CSCL 14E

An information recording and read out system is presented wherein multiple holograms are recorded in a single hologram recording medium by the use of three intersecting light beams and a lens system. Hologram patterns are formed by adding a third intersecting light beam to the two intersecting light beams normally used in hologram formation. The location of the third beam is changed for each different hologram to be formed on the medium. Read out, for the case of pattern identification, is accomplished by presenting patterns to the holographic medium and recreating and sensing the position of the third beam. NASA

N70-12649*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Florida Research and Development Center.
SUPPRESSION OF COMBUSTION OSCILLATIONS WITH MECHANICAL DEVICES Interim Report
G. D. Garrison, A. C. Schnell, C. D. Baldwin, and P. R. Russell 8 Aug. 1969 130 p refs
(Contract NAS8-21310)
(NASA-CR-107102; PWA-TR-3299) Avail: CFSTI CSCL 14B

Results are discussed for a program aimed at improving the acoustic liner design theory in the high frequency and high sound pressure regime, and demonstrating the techniques required for the measurement of absorbing liner acoustical characteristics during hot firings of rocket chambers using a cold flow acoustic device. Twenty-three resonator assemblies were used in a high frequency impedance measuring device to supply data for analysis. More than 300 data points were obtained at sound pressures up to 176 db. A static rocket thrust chamber simulator was used to provide preliminary acoustic data for the basic design of a cylindrical cold flow type apparatus. Simulator experiments with flow past or with flow through the apertures showed that the empirical theory, derived from probe-type impedance tubes, predicted effects of flow on resistance to be significantly greater than that measured using the pressure-phase impedance measuring techniques. J.A.M.

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N70-11448*# Lockheed Missiles and Space Co., Palo Alto, Calif. Material Sciences Lab.
STUDY OF GAS-TUNGSTEN-ARC WELDING POWER DENSITY Final Report, 1 Jun. 1968 - 30 May 1969
R. F. Karlak and A. R. Pfluger 12 Jun. 1969 166 p refs
(Contract NAS8-21373)
(NASA-CR-102301) Avail: CFSTI CSCL 13H

A theoretical and experimental program was conducted to analyze and characterize the normal gas-tungsten arc, particularly with regard to power density, and to perform experiments designed to increase GTA power density. Measurements were made of the distribution of current, heat flux, and plasma-stream pressure on the anode surface as well as the distribution of continuous radiation intensity from the plasma close to the anode surface. The arcs studied were operated with argon or helium shielding at currents from 150 to 300 A and arc lengths from 1 to 3 mm (and longer in certain cases) on both water -cooled copper and molten aluminum using 3/16-in.-diameter 2% thoriated tungsten cathodes (electrodes) tapered to either a 55-mil or 94-mil-diameter tip. The third phase consisted of experiments with welding arcs modified to increase GTA power density. Power densities of the order of 10,000 W/sq in. were measured with the normal GTA and over 1 million W/sq in. with the modified arcs. These levels still do not approach the 10 to the 7th power to 10 to the 8th power W/sq in commonly obtained in electron beam welding. Author

N70-11617# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INCREASING THE WEAR RESISTANCE OF STEEL PARTS BY SURFACE HARDENING
P. G. Alekseyev 17 Jul. 1969 8 p Transl. into ENGLISH from Stanki i Instrument (USSR), v. 39, no. 1, 1968 p 7-9
(AD-693496; FTD-HT-23-935-68) Avail: CFSTI CSCL 13/9

The effect of plastic deformation on the wear resistance of 10, 20, 45, and U12 steels was studied on cylindrical experimental specimens in a MI-1M machine. The degree of wear was obtained by removing crescent-shaped fragments from the specimen and determining their weight loss on an analytical balance. The microhardness of the specimens was determined with PMT-3 apparatus and the surface roughness with a Kalibr VEI profile meter. The experimental results are shown. The wear resistance of these steels was increased considerably by surface plastic deformation; the deformation pressure constitutes the most important single factor determining the wear resistance of a treated surface. For pressures below optimal, the wear resistance of a surface fall-

below the maximum, while application of pressures in excess of the optimal results in an over-hardened surface. TAB

N70-11685# Army Foreign Science and Technology Center, Washington, D.C.

A DYNAMIC INVESTIGATION OF ONE TYPE OF SHOCK ABSORBING APPARATUS

A. G. Ovakimov 15 Aug. 1969 15 p ref Transl. into ENGLISH from Mashinovednie (USSR), no. 1, 1968 p 42-45
(AD-693012; FSTC-HT-23-286-69) Avail: CFSTI CSCL 13/4

An investigation is made of the motions of a system consisting of a shock absorber fastened to a container in order to absorb kinetic energy upon landing. A simplified mathematical method of dynamic analysis is described. Author (TAB)

N70-11691# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FUSION WELDING OF TITANIUM AND ITS ALLOYS

F. E. Tretyakov 30 Jun. 1969 60 p refs Transl. into ENGLISH of the publ. "Svarka Plavleniyem Titana i Yego Splavov" Moscow, Izd. Mashinostr., 1967 p 1-144
(AD-693498; FTD-HT-23-312-68) Avail: CFSTI CSCL 13/8

Fusion welding is considered as a leading technological process in making welded structures of titanium and its alloys used in the aircraft industry. The book is based on studies directed toward creating a rational technology of fusion welding assuring high structural strength of the welded joints and reliable operation of welded structures made from titanium alloys, as well as on material from the Soviet and foreign technical literature. TAB

N70-11804# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

NATURE OF FRICTION IN EXTRUSION BY A HIGH PRESSURE FLUID

V. E. Slobtsov 20 Jun. 1969 6 p refs Transl. into ENGLISH from Fiz. I. Kaimiya Obrabotki Materialov (Russian), no. 6, 1967 p 73-75
(AD-693463; FTD-HT-23-172-69) Avail: CFSTI CSCL 13/8

Conditions for the existence of hydronamic lubrication in the extrusion of high pressure fluid were determined mathematically assuming the pressure fluid is a Newtonian fluid whose density is constant and flow is laminar, and viscosity is related to pressure. The Reynolds equation was used. It was found that fluid or essentially fluid friction is possible in the extrusion of extreme pressure fluid only when i.e. at definite extrusion rates, lubricant viscosity, and angle of taper of the die inlet cone. When the aforesaid condition is fulfilled at the beginning of the area of deformation, friction at the outlet will be limited or essentially limited when: (a) the viscosity of the lubricant at the outlet is many times smaller than at the inlet in the area of deformation, due to reduction of the normal pressure of the stock on the die and heating of the lubricant, and (b) a sharp break in the normal pressure occurs at the outlet from the deformation area. The thickness of the lubricant layer at the outlet and its flow is determined mainly by the surface activity and the plastic properties of the lubricant. The thickness of the layer at the inlet to the area of deformation depends on its flow rate. Articles with high quality surface may be prepared from stock with poor surface quality because of the presence of two zones at the contact surface of the stock and die. Author (TAB)

N70-11817# Dow Chemical Co., Golden, Colo. Rocky Flats Div.

LOW RANGE MOIST AIR GENERATOR

Daniel J. Mc Guire 10 Jun. 1969 7 p
(Contract AT(29-1)-1106)
(RFP-1290) Avail: CFSTI

A relatively inexpensive, manually operated, moist-air generator is described. The generator provides moisture levels from 5ppM by volume to 50-percent relative humidity. It serves as a stable source of moist air for environmental comparison and calibration of humidity measuring equipment. Construction details of the moist-air generator are given. Author (NSA)

N70-11872# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PREPARATION OF SHOP COMPONENTS DIRECTLY FROM ALUMINUM POWDERS OF GRADES APS-3 AND APS-4

V. A. Onoprienko et al 6 Jun. 1969 7 p refs Transl. into ENGLISH from Alyumin. Splavy. Vypusk 5 Konstrukt. Splavy. Sbornik Statev (Moscow), 1967 p 249-254
(Contract F33657-68-D-0865-P002)
(AD-693481; FTD-HT-23-1353-68) Avail: CFSTI CSCL 11/4

Production techniques for the hot stamping and hot pressing of blanks from APS-1, APS-2, APS-3 and APS-4 aluminum powders were developed. It was established that hot pressing is best carried out with the aluminum powders heated to 600 degrees C in dies with 5-10 degree cones on the outer surface. Hot three-dimensional stamping of briquettes of aluminum powder or hot pressing directly from aluminum powders was chosen on the basis of configuration and dimensions as well as availability of appropriate plant equipment. The use of these methods reduces the over-all production cycle as well as total cost, since aluminum powder is 1/5th the cost of sintered aluminum powder SAP rods. TAB

N70-11874*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.

EXPERIMENTS IN HYDRODYNAMIC GREASE BEARINGS

John L. Burch and Peter H. Broussard, Jr. 5 Sep. 1969 15 p refs
(NASA-TM-X-53871) Avail: CFSTI CSCL 13I

The suitability of using hydrodynamic conical and spherical shaped spiral grooved grease bearings as a replacement for gyro ball bearings has been investigated. Grease bearings have been built and tested for rotors which vary in diameter from a few centimeters to 30.5 centimeters and in weight from a few grams to 22.7 kilograms. Speeds from 12,000 to 50,000 rpm have been maintained for hundreds of hours in both air and vacuum environments. Generally, these bearings have operated satisfactorily and retained their lubricant. Author

N70-11875*+ American Bosch Arma Corp., Philadelphia, Pa.

FLUID LUBRICATED MAGNETIC TAPE TRANSPORT TEST MODEL Quarterly Report, 5 Jun.-5 Aug. 1969

5 Aug. 1969 22 p
(Contract NAS5-21017)
(NASA-CR-107015; QR-1) Avail: CFSTI CSCL 13I

An experimental model shows that an externally pressurized fluid film may be introduced between the magnetic head and tape of a magnetic tape recorder to greatly increase life of these members without seriously reducing the signal to noise ratio. It is shown that a film as great as .0002 inches can be tolerated for a satisfactory signal to noise ratio, and capillary size, fluid flow, and other parameters are established by analysis. It is shown that the perfluorinated fluids are at present the best choice for this service. Author

N70-11925# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF MACHINING SPEED ON CUTTING TEMPERATURE DURING HIGH-SPEED TURNING

V. V. Vishnyakov 23 May 1969 3 p ref Transl. into ENGLISH from Tr., Kishinev Politekh. Inst. (Kishinev), 1966 p 241-242
(AD-693514; FTD-HT-23-56-69) Avail: CFSTI CSCL 11/6

The cutting temperature was measured in turning aluminum at cutting speeds of 50-33 m/sec. The cutting tool was of VK8 hard alloy and the readings were recorded with an N-102 oscillograph. It was found that the cutting temperature increases nonuniformly with an increase in cutting speed. At 50-100 m/sec, the temperature increase is not so great, and at 120-170 m/sec there is almost no increase. It is assumed that, with an increase in the tangential component of the cutting force at high speeds, friction on the leading edge of the cutting tool is increased, thereby increasing the cutting temperature. TAB

N70-11948# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PNEUMATIC SPRING WITH HYDRAULIC SHOCK ABSORBER

Z. L. Sirotkin et al 23 May 1969 4 p Transl. into ENGLISH from Russian Patent no. 190222 (Appl. no. 761886127-11, 24 Jan. 1962) 3 p

(AD-693512; FTD-HT-23-17-69) Avail: CFSTI CSCL 13/6

This patent describes a pneumatic spring with a hydraulic shock absorber, principally for heavy automobiles. This device is distinguished by the fact that, in order to regulate the oscillation frequency, it is provided with an annular counterpressure chamber, formed by the spring body and the main cylinder, filled with compressed gas and a working fluid and connected with the cavity between the rod and main cylinder using tubes, a section of which is provided with a check valve, which are submerged below the level of the fluid of the counterpressure chamber. The spring is distinguished by the fact that, with the aim of simplifying the design, the plunger pump is placed outside the spring and connected by tubes with the oil collecter and cavity of the main cylinder. Author (TAB)

N70-11999# Mound Lab., Miamisburg, Ohio.

SIMPLE, ECONOMICAL, HIGH-INTEGRITY HIGH-VACUUM SEALS

J. H. Birden 3 Jul. 1969 6 p refs

(Contract AT(31-1)-GEN-53)

(MLM-1653) Avail: CFSTI

A seal was developed for use in ultrahigh vacuum systems and for containment of radioactive materials in storage containers. The seal is basically a metal foil which is used in conjunction with a precision-machined sealing surface. The foil can be reused several times with satisfactory results. Seals of nickel, tantalum, and gold were satisfactory for most purposes, while aluminum gave good results under certain conditions. Author (NSA)

N70-12099# Hamburg Univ. (West Germany). Mathematisch-Naturwissenschaftliche Fakultat.

ON THE TRIBOLOGY OF MOLYBDENUM DISULFIDES UNDER VARIOUS CONDENSABLE VAPORS AT REDUCED PRESSURE [ZUR TRIBOLOGIE DES MOLYBDENUM DISULFIDES UNTER VERMINDERTEM DRUCK VERSCHIEDENER KONDENSIERBARER DA EMPFE]

Heinz Greve (Ph.D. Thesis) 1968 65 p refs In GERMAN

Avail: CFSTI

The behavior in the lubricating properties of molybdenum disulfide is studied under conditions varying between a gaseous atmosphere and increasing vacuum. The vapors used were of water, ketones, and paraffins. The differences in the effects are due to the polar and adsorptive character of the gas molecules. At low vapor pressures lubrication is impaired by an inhibition of dislocations but it is improved under higher pressures owing to a weakening of the interlamellar forces. These results have been corroborated by comparison with X-ray diffractive and adsorption measurements. ESRO

N70-12103*# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.

APPLICATION OF BLADE-ELEMENT TECHNIQUES TO DESIGN AND PERFORMANCE PREDICTION PROBLEMS FOR AXIAL-FLOW TURBOMACHINERY Progress Report, 1 Apr. - 30 Sep. 1969

T. H. Okiishi, M. J. Miller, P. Kavanagh, and G. K. Serovy 30 Sep. 1969 16 p refs

(Grant NGL-16-002-005; Proj. 407S)

(NASA-CR-106975; ERI-61400) Avail: CFSTI CSCL 13L

Research directed toward developing improved methods for hydrodynamic design and prediction of performance of axial-flow pumps is underway. To expedite the data correlation associated with empirical prediction of axial flow pump deviation angles and total head loss coefficients, isolated rotor data for 11 different axial flow pump rotor configurations were organized and stored on magnetic tape in a uniform format so that retrieval for data analysis would be simplified. A summary of the data considered is included. Tests of three of several approaches to correlation of deviation angle data are discussed. Preliminary conclusions associated with total head loss coefficient correlation development are also mentioned. Author

N70-12192*# Mechanical Technology, Inc., Latham, N.Y.

RESEARCH AND DEVELOPMENT OF HIGH TEMPERATURE GAS BEARINGS. VOLUME 1: ANALYSIS AND DESIGN OF THREE GAS BEARINGS FOR HIGH TEMPERATURE OPERATION

H. Cheng, D. Wilson, E. B. Arwas, and V. Castelli Washington NASA Nov. 1969 168 p refs

(Contract NAS3-9433)

(NASA-CR-1476; MTI-69TR21-Vol-1) Avail: CFSTI CSCL 13I

The work conducted during the analytical and design phase of the technology program on high-temperature, self-acting (hydrodynamic), gas-lubricated bearings for Brayton cycle machinery comprised: (1) A screening analysis was made of several journal and thrust bearings from the standpoint of their relative merits for operation without external cooling in a high temperature, nonisothermal environment in compact, high-speed rotating machinery. This screening study led to the selection of one rigid surface journal bearing concept, one conformable surface journal bearing concept, and one thrust bearing concept for detailed design and analysis. (2) The selected bearing concepts were designed, including preparation of a detailed layout drawing and materials list for each concept. These layout drawings and materials list have been separately issued to the NASA. (3) Detailed analysis and computation of the performance of the selected bearing concepts, in a high temperature nonisothermal environment, included the influence of thermal distortions, for a specified range of operating conditions. Author

N70-12236# National Gas Turbine Establishment, Pyestock (England).

HALF-SPEED BEARING WHIRL EXCITED BY A SINGLE PROPAGATING STALL CELL IN A MULTI-STAGE AXIAL-FLOW COMPRESSOR

J. Ringrose 1969 16 p ref Supersedes NGTE-R-298; (ARC-R/M-3598; NGTE-R-298) Avail: HMSO 8s 6d; BIS$1.70

A plain journal bearing is spontaneously unstable above a critical speed and loses much of its load carrying capacity when subjected to a load rotating at about half the speed of the shaft. The almost axially symmetric flow in a compressor can break down at low flow into a rotating pattern of stall cells but only the special case of a single propagating stall cell gives rise to a mechanical couple about an axis normal to and rotating about the axis of the machine. It was observed in a multi-stage axial-flow compressor that the propagational speed of a single stall cell coincided with the dynamic weakness of the two plain bearings supporting the rotor and resulted in severe vibration at about half the shaft speed. This was interpreted as an excited half-speed bearing whirl and is believed to be a unique observation. Author (ESRO)

N70-12247# Royal Aircraft Establishment, Farnborough (England).

A SUGGESTED LIQUID NITROGEN TRANSFER SYSTEM

B. A. Knight Jan. 1969 14 p

(RAE-TR-69005) Copyright. Avail: CFSTI

The system described has been designed to enable a cryogenic

shroud in a vacuum facility to be maintained at liquid nitrogen temperatures. The method employs a primary supply dewar which is maintained full of liquid nitrogen from an interchangeable secondary dewar.
Author (ESRO)

N70-12250# Royal Aircraft Establishment, Farnborough (England).
A REVIEW OF PNEUMATIC PISTON TYPE ACTUATORS FOR PROSTHETICS
A. G. Earl Apr. 1969 33 p ref revised
(RAE-TR-68027-Rev) Copyright. Avail: CFSTI

The gas consumptions of several arrangements of piston type actuators when operating under various loads are calculated. It is shown that a differential area type actuator operating with the piston rod normally in tension is markedly more economical than other arrangements, particularly when operating against uni-directional loads. When operating against bi-directional loads this design still uses less gas than a conventional double-acting actuator. Several recommendations are made on design aspects as a result of the practical implications revealed by these calculations.
Author (ESRO)

N70-12265# Atomic Energy Commission Research Establishment, Risö (Denmark). Metallurgy Dept.
LABORATORY CONTINUOUS FURNACE FOR SINTERING OF URANIUM DIOXIDE PELLETS
O. Toft Soerensen Apr. 1969 14 p ref
(RISO-198) Avail: CFSTI

In connection with the Danish fuel-element development program a laboratory high-temperature continuous furnace for sintering of UO2 pellets was designed and constructed at the Danish Atomic Energy Commission Research Establishments, Riso. The furnace system, which consists of automatic loading and unloading units, a tube furnace and a temperature-regulation unit, is described together with the steps involved in a typical sintering in the furnace. To illustrate the suitability of the system developed, typical densities, density- and diameter tolerances and impurity contents of UO2 pellets sintered at 1700 C are given, and finally the experience gained during long-time performance of the system is described.
Author (ESRO)

N70-12286 National Lending Library for Science and Technology, Boston Spa (England).
THE PROBLEM OF INTERCRYSTALLINE AND KNIFE-LINE CORROSION OF WELDS IN CORROSION-RESISTANT STEELS
V. Chihal et al 12 Mar. 1969 21 p refs Transl. into ENGLISH from Metalloberflaeche (Munich), No. 22, 1968 p 368–377 In ENGLISH and GERMAN
(NLL-Trans-746-85-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.

The ability to withstand knife-line corrosions in the immediate vicinity of the weld seam was investigated. The input effect of electroslag welding was determined. Corrosion tests on electroslag-welded joints were performed in a standard solution, a Streicher solution, and in nitric acid. The two stage heat treatment was effective in reducing the corrosion rate in the narrow, superheated zone adjacent to the weld in nitric acid. Corrosion test results were applied to explain corrosion in welded joints produced by automatic welding equipment.
J.A.M.

N70-12288# AEG-Telefunken, Heilbronn (West Germany).
A STUDY ON THE DEVELOPMENT OF IMPROVED INTERCONNECTION TECHNIQUES FOR SILICON SOLAR CELL ARRAYS Final Report, 1 Feb. 1968 – 31 Jan. 1969
H. Fischer, J. Gehrke (AEG-Telefunken, Wedel), R. Gereth, and W. Pschunder Paris ESRO Jun. 1969 71 p
(ESRO-CR-8) Avail: CFSTI

Improved interconnection techniques for Si solar cells have been investigated and a major breakthrough in contact technology has been achieved by the development of a solderless contact which allows the use of welded interconnections in solar cell modules. These modules can withstand temperature ranges from −190 C to + 150 C and exposure to + 400 C without degradation. The new technique based on the electrochemical passivation of Ti/Ag contacts by means of a Pd interlayer between Ti and Ag eliminates the need for a heavy solder layer to protect the contact against corrosion in a humid environment. Silicon solar cells with passivated Ti(Pd)Ag contacts have withstood exposure of + 90 C and 100% relative humidity for 1200 hours without failure.
Author (ESRO)

N70-12319# Singer-General Precision, Inc., Little Falls, N.J. Kearfott Div.
LOW COST PRODUCTION OF A FLUIDIC MISSILE CONTROL SYSTEM Final Report
John Evans and Jay Hoffman Redstone Arsenal, Ala. Army Missile Command Jun. 1969 277 p
(Contract DAAH01-68-C-1305)
(AD-690853) Avail: CFSTI CSCL 13/7

The purpose of the study is to investigate all the costs associated with the mass production of a fluidic directional control system for a tactical artillery missile. This report considers the following factors influencing the cost of the control system: performance requirements; design of system sub-assemblies; specific improvements in design of sub-assemblies; production manufacturing techniques for system sub-assemblies; production assembly techniques for sub-assemblies and the system; production tests required for adequate quality assurance; and areas where further development will lead to improvements in cost or weight or performance. The report also defines the estimating philosophy used and the labor rates used to generate the cost estimate.
Author (TAB)

N70-12337# Technische Hochschule, Darmstadt (West Germany). Fakultät für Maschinenbau.
THE INFLUENCE OF FRICTION CORROSION ON THE SYSTEM LIFE OF COMPOSITE MACHINE ELEMENTS [DER EINFLUSS DER REIBKORROSION AUF DIE DAUERHALTBARKEIT ZUSAMMENGESETZTER MASCHINENELEMENTE]
Wolfram Funk (Ph.D. Thesis) 7 Jul. 1968 138 p refs In GERMAN
Avail: CFSTI

A testing method has been developed which permits the investigation of the influence of friction corrosion on the long term strength of a shackle connection, by means of measuring slip and pressure. The motions occurring at the contact surface of the shackle are treated mathematically, showing the occurrence of sliding slip to be the cause of corrosion. Long term vibration tests show that failure begins with fissures which extend owing to the surface oxidation. Design rules are deduced to avoid failures due to friction corrosion.
ESRO

N70-12422# South Carolina Univ., Columbia. Coll. of Engineering.
THE EFFECT OF DIE ROTATION ON THE COMPACTION OF METAL POWDERS Progress Report
E. G. Schwartz and L. F. Hammond (M.S. Thesis) 1969 41 p refs
(Contract AT(38-1)-475)
(SRO-475-2) Avail: CFSTI

By considering the equilibrium of an element of powder it is shown that the axial stress within the compact follows an exponential decay. By assuming that radial stress is related to the axial stress by a constant, k, and also the shear stress is related to the radial stress by the coefficient of friction mu it is shown that the radial stress and shear stress also follow an exponential decay. The constants k and mu are evaluated by assuming that a shear stress exists at the compact-die interface greater than the shear strength of aluminum. A comparison is presented of the measured loads on a compact for static compactions and then for rotation. The experimental graphs of primary interest are die wall friction versus applied axial stress and the transmitted stress versus the applied axial stress. The prime conclusion drawn is that die

wall rotation during the pressing of metal powders can substantially reduce die wall friction. Author (NSA)

N70-12513# Sundstrand Aviation-Rockford, Ill.
CONDENSATE PUMP INVESTIGATION. AEC ORGANIC RANKINE CYCLE TECHNOLOGY PROGRAM
R. E. Niggemann and L. J. Suit [1968] 63 p refs
(Contract AT(04-3)-651)
(SAN-651-100) Avail: CFSTI

A program to evaluate pumps applicable to low back pressure organic Rankine cycle space power systems is described. Two pumps were fabricated and tested; one for low pressure condensate, which requires a jet pump inducer when used in space power systems, and the other for high pressure condensates typical of jet condenser systems. The efficiency of the jet condenser was found to be satisfactory. The efficiency of the pump for low pressure condensate was found to be at the lower end of the efficiency range based on previous work on similar pumps. Author (NSA)

N70-12518# Oak Ridge National Lab., Tenn.
EXPERIMENTAL FABRICATION OF ZIRCALOY-4 TUBING
T. M. Nilsson and P. L. Rittenhouse Aug. 1969 23 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2576) Avail: CFSTI

The planning of 12 fabrication schedules for Zircaloy-4 tubing and the manufacture of tubing according to these schedules are described. The tubes are being used in a study of the influence of fabrication variables on crystallographic texture and anisotropy of mechanical properties. Extruded tube shells were fabricated to final size by tube reducing and by combinations of tube reducing and drawing, planetary swaging, and hammer swaging. Under constant annealing conditions, the grain size of the finished annealed tubing seemed to depend primarily on the amount of cold work or the cold working sequence. Other fabrication variables seemed to be of only minor importance. Author (NSA)

N70-12678# Oak Ridge National Lab., Tenn. Isotopes Div.
OAK RIDGE NATIONAL LABORATORY TUNGSTEN-SHIELDED CASK
R. D. Seagren Aug. 1969 38 p
(Contract W-7405-eng-26)
(ORNL-TM-2626) Avail: AEC Depository Libraries

A small, light-weight, tungsten-shielded shipping cask was designed, fabricated, and approved for the national and international transport of large quantities of solid and liquid nonfissile radioactive material. The design effects reduction of the weight and volume of the cask and minimizes problems previously associated with transporting casks of this type and handling them in hot cells. The shielding material selected meets the requirements of national and international regulatory groups. Author (NSA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N70-11452# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
ERBIUM LASER PROPAGATION IN SIMULATED ATMOSPHERES. PART 1: DESCRIPTION OF EXPERIMENTAL APPARATUS AND PRELIMINARY RESULTS
R. B. Gomez and K. O. White Jul. 1969 45 p refs
(AD-693254; ECOM-5260) Avail: CFSTI CSCL 20/5

Initial results are presented of an experimental study utilizing an absorption cell facility to determine erbium laser propagation characteristics in simulated atmospheres. The facility consists of a 3.3-meter spectrometer coupled to a 20-meter multipass absorption cell. The cell environment can be controlled over a wide range of pressures, temperatures, humidities, and gas concentrations. Absorption measurements were made with path lengths varying from 400 to 1600 meters in a simulated atmosphere consisting of clean dry air. The initial experimentally measured attenuation of 1.54 micron radiation by clean dry air is less than 25% per km. The results include the discovery of a new emission line of the erbium laser at 1.544 microns and the simultaneous emission of lines at 1.544 and 1.536 microns. Author (TAB)

N70-11460# Raytheon Co., Waltham, Mass. Research Div.
MATERIALS FOR HIGH-POWER CARBON DIOXIDE LASERS Final Technical Report, 8 Aug. 1968 - 8 May 1969
Robert L. Rudko and Frank A. Horrigan Sep. 1969 109 p refs
(Contract DAAH01-69-C-0038)
(AD-693311; S-1170) Avail: CFSTI CSCL 20/5

The report discusses window and mirror materials suitable for high-power 10.6 micron operation. An extensive survey of candidate materials is presented, including all pertinent physical parameters, as well as an assessment of the ultimate power-handling capabilities of each. Experimental measurement of the optical absorption coefficients was carried out wherever necessary. Major emphasis was placed upon the semiconducting window materials because of their superior mechanical properties. The thermal runaway mode of failure, characteristic of these materials, was analyzed in some detail for germanium, indium antimonide and gallium arsenide. The primary conclusions are that gallium arsenide remains the best candidate material for high-power windows and that indium antimonide is an interesting and very promising candidate for high-power 10.6 micron optical isolator applications. Author (TAB)

N70-11462# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
REPORT OF THE MOUNT HALEAKALA OBSERVATORY: FLUORESCENCE AS A SOURCE OF NOISE IN Q-SWITCHED RUBY LASER ATMOSPHERIC BACKSCATTERING EXPERIMENTS
P. Mc Cormick Sep. 1969 21 p refs
(Contract DAHC15-68-C-014)
(AD-693493; Rept-1386-7-T) Avail: CFSTI CSCL 17/8

Interpretation of the results of atmospheric backscattering experiments, when using a Q-switched ruby laser as the source of photons, requires consideration of several sources of noise in the statistical analysis. This report discusses the effects of directly backscattered ruby fluorescence in detail. It is found that, for an unshuttered system, fluorescence noise will be equal to the signal expected from altitudes above about 50-60 km (assuming only a molecular atmosphere). The crossover altitude is lowered if aerosols are present. When a shutter is used as a fluorescence block, it is found that a spurious layer structure may be produced--but only for shutter cutoff times of greater than about 375 microseconds. It is concluded that, for a properly designed optical radar system, ruby fluorescence will not be a significant source of spurious returns. In particular, it is concluded that this source will not explain the enhanced returns from altitudes of about 80 km observed by McCormick. Author (TAB)

N70-11476# Aerospace Corp., El Segundo, Calif. Aerodynamics and Propulsion Research Lab.
CHEMICAL KINETICS OF HYDROGEN HALIDE LASERS VOLUME 1: THE H2-Cl2 SYSTEM, AUGUST 1968 - MAY 1969
Norman Cohen 30 Jul. 1969 41 p refs Revised
(Contract F04701-69-C-0066)
(AD-693561; TR-0066(5240-20)-1-Vol-1; SAMSO-TR-69-269-Vol-1) Avail: CFSTI CSCL 7/5

A detailed kinetic model of the HCl chemical laser produced by the flash photolytically initiated H2--Cl2 explosion is described, and the results of computer calculations on such a system are discussed. It is shown that currently accepted values of the various rate constants, supplemented in a few cases by reasonable estimates of previously unmeasured rate constants, are adequate to approximate the observed laser behavior of this system. It is also

shown that the chemistry of such a system is extremely complex, and exhibits a high degree of coupling between one reaction and another; therefore, great care is required to extract kinetic data from the optical behavior of such laser systems. It is further argued that different hydrogen halide lasers may behave quite differently from each other, depending on the relative magnitudes of the various rate constants involved. Author (TAB)

N70-11814# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

LASERS ON SOLUTIONS OF ORGANIC DYES WITH PULSE LAMP EXCITATION

A. N. Rubinov et al 4 Jun. 1969 12 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR (Minsk), v. 12, no. 7, 1968 p 602 - 605

(AD-693420; FTD-MT-24-118-69) Avail: CFSTI CSCL 20/5

The laser action characteristics of several organic dye solutions are analyzed experimentally. The dye solution is placed in a quartz or molybdenum cell cylindric in shape, and pumped by two pulsed in-series IFP-1200 lamps 100 mm long and 3-5 mm in internal diameter. The light pulse has a duration of 60 sec. Because of the large stimulated emission coefficient laser, generation of dyes requires a much smaller population of excited particles. The three most promising dyes studied were rhodamine C, rhodamine 6G, and pyronine G. A table is prepared for rhodamine 6G, listing the wavelength of the laser beam as a function of the active particle concentration. Author (TAB)

N70-11949# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HEATING AND DESTRUCTION OF THIN FILMS BY LASER (OKG) RADIATION

M. N. Libenson 9 Jun. 1969 19 p refs Transl. into ENGLISH from Fiz. i Obrabotki Materialov (Russian), no. 2, 1968 p 3 - 11

(AD-692636; FTD-MT-24-47-69) Avail: CFSTI CSCL 20/5

This is a theoretical analysis of the interaction between a powerful light flux and thin films of absorbent material. The question is directly related to a number of applications of laser radiation in film technology and also to the use of thin coatings as a reflecting surface of laser mirrors. The considerations are based on a heat model of destruction of opaque media. In these models, the interaction of laser radiation with the medium may be divided into several stages: (1) energy transfer (from absorption of radiant energy to conversion to heat), (2) heating material to a temperature corresponding to the beginning of disintegration, (3) disintegration of material and removal of the disintegration products, and (4) cooling of the material after termination of the interaction. All these stages likewise characterize thin films, but films also exhibit special features associated chiefly with a substantial effect on the optical properties of the films, their granular structure, and with the dependence of these properties and heating rates of the film on film thickness and also on the properties of the substrate material. Author (TAB)

N70-11959*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.

A MOLECULAR BEAM PRIMARY REFERENCE FOR LONG-TERM FREQUENCY STABILIZATION

Shaoul Ezekiel (Ph.D. Thesis) Apr. 1968 212 p refs

(Grant NGL-22-009-010)

(NASA-CR-106963; TE-24) Avail: CFSTI CSCL 20E

The principal objective is to find an atomic or molecular resonance, that can be excited by a laser in a molecular beam, to serve as a highly stable frequency reference in the feedback stabilization of the laser frequency. The result of the search is the observation, for the first time, of a laser induced transition in a molecular beam. It has been demonstrated that a single longitudinal mode 5145 A argon ion laser induces resonance fluorescence of iodine in a molecular beam. The fluorescence first appears when the laser frequency is 600 MHz above the center of the laser gain curve and extends over a range of approximately 1300 MHz. Author

N70-12040# Idaho Nuclear Corp., Idaho Falls.

BIBLIOGRAPHY OF LASER PUBLICATIONS OF INTEREST TO EMISSION SPECTROSCOPISTS, No. 3

Jon M. Baldwin, ed. Jul. 1969 12 p refs

(Contract AT(10-1)-1230)

(IN-1305) Avail: CFSTI

Ninety-nine references continue the literature coverage of the previous reports, IN-1219 and IN-1262, to June 1, 1969. NSA

N70-12093*# Martin Co., Orlando, Fla.

INVESTIGATION OF LASER FREQUENCY STABILIZATION

Vincent J. Corcoran, Richard E. Cupp, William T. Smith, and James J. Gallagher Washington NASA Dec. 1969 63 p refs

(Contract NAS12-2008)

(NASA-CR-1461) Avail: CFSTI CSCL 20E

Investigations were performed on the stabilization of a far infrared laser. Both phase stabilization and frequency stabilization were considered. Theoretical treatment of the phase-locking process was made and experimental studies were performed on the phase-locking of the laser to a harmonic of a frequency standard. Stability characteristics of the laser systems were studied, and two of the HCN lasers, operating on the 890 GHz line, were heterodyned to yield linewidths on the order of 10 kHz. An AFC loop was employed to lock the HCN laser to the frequency standard. A stability on the order of 1 part in 10 to the 8th power was achieved. Author

N70-12209*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

A DIRECT MEASUREMENT OF THE MOST PROBABLE PREFERRED ANGULAR VELOCITY OF TURBULENT STRUCTURES BY OPTICAL CORRELATION OF LASER SCHLIEREN SIGNALS

B. H. Funk 26 Aug. 1969 40 p refs

(NASA-TM-X-53870) Avail: CFSTI CSCL 20E

A method which potentially provides the means for separating the translational and rotational motion of turbulent structures is introduced. Simple two-dimensional models are used to relate the skewness of cross-correlograms commputed from laser schlieren signals to the rotation of flow disturbances. The method, referred to herein as the method of forced similarity, is discussed with respect to application to the turbulent free shear layer of an axisymmetric supersonic jet. Experimental results show that the shape of the cross-correlogram in the neighborhood of the peak is strongly influenced by rotational motion, and therefore, it becomes necessary to account for the effect in order to determine the correct statistical properties of the turbulence. Author

N70-12388# Oxford Univ. (England). Dept. of Engineering Science.

THE LASER TRIGGERED SPARK GAP

Shaukat Hameed Khan (Ph.D. Thesis) 1969 212 p refs

(Grant AF-EOR-33-67)

(AD-693239; Rept-106768) Avail: CFSTI CSCL 20/3

The experiment reported here is an extension of earlier work in this laboratory on the interaction of laser beams with metallic surfaces. It was conducted with the view of investigating the feasibility of the laser beam as a trigger for high voltage gaps. The formative times were studied as a function of the working voltage for different values of pressure, gap spacing and laser power. They were found to vary inversely as the gap pressure p, and exponentially with the gap spacing d for spacings greater than 4 mm. For gaps shorter than this, no effect of variation in d was noticed. The formative times also showed an inverse exponential dependence on the laser power in the range of laser powers considered (1.6 - 8 MW). Using N2 as a standard, the formative time curves showed a distinct improvement as oxygen was added. Pure O2 gave faster times than air and air showed slightly better switching times than N2. A similar improvement was observed when the argon content in argon/nitrogen mixtures was increased. Author (TAB)

N70-12523# National Bureau of Standards, Boulder, Colo. Quantum Electronics Section.
LASER POWER AND ENERGY MEASUREMENTS
D. A. Jennings, E. D. West, K. M. Evenson, A. L. Rasmussen, and W. R.Simmons Oct. 1969 70 p refs
(NBS-TN-382) Avail: SOD $0.65

Calorimeters for measuring the output of energy of pulsed ruby and neodymium glass lasers were built and calibrated. The absorbing medium was an aqueous solution of copper sulfate. Calibration of laser energy detectors had an estimated uncertainty of plus or minus 2% for input energies of 0.1J to 100J. Comparisons of absorption cell calorimeters with metal plate calorimeters agreed within 1%. Instrumentation is described that is used for the calibration of CW laser power meters. A discussion and description is also given of several types of calorimeters that were used to measure the output of a 100 watt carbon dioxide laser. Author

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N70-11401*# North American Rockwell Corp., El Segundo, Calif.
PH14-8Mo STAINLESS STEEL HONEYCOMB CORE SHEAR STRENGTH AT ELEVATED TEMPERATURES, 1 JULY 1968 – 1 JULY 1969
G. H. Arvin, D. A. Pantone, and T. E. DeWitt 1 Jul. 1969 70 p
(Contract NAS9-8327)
(NASA-CR-102000; NA-69-746) Avail: CFSTI CSCL 11F

The fabrication and testing of PH14-8Mo stainless steel honeycomb sandwich specimens are described for developing shear strength data at elevated temperatures for 3-15, 3-20, 3-30, and 2-30 honeycomb core. The brazing fabrication of four stainless steel honeycomb panels in accordance with the pertinent Apollo specifications is discussed. The equipment used to conduct the shear tests along with test setups and procedures are described. Pictures of the heat shield from the Apollo Spacecraft 011 after orbiting and reentry are included, showing the specific locations of the heat shield specimens which were also tested and reported. A tabular listing of specimen sizes and test results along with photographs of typical longitudinal and transverse ribbon direction failures at each test temperature for each honeycomb core configuration tested are included. Also presented is an evaluation of the test data and curves for the core shear strength versus temperature (to 900 F) for each of the four core densities. The test data points are shown on these curves. Author

N70-11423# Advisory Group for Aerospace Research and Development, Paris (France). Structures and Materials Panel.
COOPERATIVE PROGRAMME ON MECHANICAL TESTING OF REFRACTORY METALS
D. Coutsouradis (Centre Natl. de Rech. Met.) and B. P. Mullins, ed. (Roy. Aircraft Estab., Farnborough) 1968 133 p refs
(AGARD-568) Avail: CFSTI

The interlaboratory cooperative program dealt with: (1) the determination of room temperature tensile properties of Vascojet 90 steel sheet, for conventional testing techniques; (2) the same, under high temperature testing conditions, (3) the determination of the recrystallization temperature of TZM molybdenum alloy sheet; and (4) the determination of the tensile properties of TZM molybdenum alloy sheet at RT, 1050 deg, 1450 deg and 1800 deg C. The objective of the program was to generate information on the adequacy of test techniques and specifications and also on the properties of the materials tested. The report reproduces data on the variability of test results within and between laboratories. For most of the tests performed the interlaboratory variability was significantly larger than the intralaboratory one. The adequacy of test techniques and specifications is discussed in terms of the available results. Suggestions are made on the modifications of the original specifications. Author

N70-11475# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
GRAIN GROWTH IN AUSTENITIC STAINLESS STEEL, JANUARY – JUNE 1968
James K. Stanley and Anthony J. Perrotta 15 Jul. 1969 29 p revised
(Contract F04701-69-C-0068)
(AD-693562; TR-0066(5250-10)-B; SAMSO-TR-69-282) Avail: CFSTI CSCL 11/6

Despite the extensive use of Type 347 stainless steel tubing for regeneratively cooled thrust chambers, very little is known about its grain growth characteristics. Lacking, also, is information on the other 18 Cr 8 Ni austenitic steels. Therefore, grain growth curves for AISI Types 304, 316, and 321 were obtained and compared. Grain growth characteristics were established at temperatures between 1900 and 2300F, for periods of 5, 15, and 60 min. Rapid heating and cooling were used with all samples to simulate, to some degree, conditions experienced in thrust chambers. Some similarity in grain growth behavior of Types 321 and 347 was noted; rapid grain growth was found to occur at about 2000F. Some grain growth similarity also exists between Types 304 and 316; grain growth was rapid above 1900F. Where grain growth occurred, the greatest changes were during the first 15 min at temperature. Where micrographs are available in a failure analysis, these data can be used to make estimates of the temperatures to which the austenitic steel tubes were heated. Author (TAB)

N70-11481# Advisory Group for Aerospace Research and Development, Paris (France).
STRESS CORROSION. PART 1: PRACTICAL CONSIDERATIONS
G. B. Evans (Hawker Siddeley Aviation Ltd., Hatfield, Engl.) 1968 48 p refs
(AGARD-570) Avail: CFSTI

The report is a study of the present position on stress corrosion from the point of view of designers and constructors, made during 1968 for the AGARD Structures and Materials Panel. The survey is divided into two parts: Part 1 is a collection of information and views obtained by the author by written questionnaire and visits and is intended for designers and production personnel in the aerospace industry. Part 2 contains a summary of areas within the field of stress corrosion to which further research could be usefully directed, in addition to the pure research currently proceeding on the behavior of surfaces and the various mechanisms of cracking involved. This part is intended for the AGARD Structures and Materials Panel, and will not be avialable for general distribution. Author

N70-11537# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHANGE IN THE STRUCTURE OF A FRACTURE AND THE IMPACT STRENGTH OF 3X13H7C2 STEEL AS A RESULT OF OVERHEATING IN HOT WORKING UNDER PRESSURE AND HEAT TREATMENT
I. E. Konorovich et al 30 Jan. 1969 9 p refs Transl. into ENGLISH from Izv. Vyssh. Uchab. Zaved., Chem. Met. (Moscow), v. 10, no. 6, 1967 p 113–116
(AD-693455; FTD-HT-23-859-68) Avail: CFSTI CSCL 11/6

Brittle fracture with a crystalline appearance may develop in steel owing to the presence of pearlite and bainite in the

microstructure or owing to the development of temper brittleness and overheating during hot working and heat treatment. The article deals with changes in the structural appearance of fracture of 3X13H7C2 steel (0.28 percent C, 2.5 percent Si, 0.55 percent Mn, 12.9 percent Cr, 6.95 percent Ni, 0.20 percent S, 0.025 percent P) due to overheating during die forging at 850, 950, 1050, 1150 and 1200 degrees C (degree of deformation 40 percent) and heat treatment (quenching from 1050 degrees in water (40 min) plus annealing at 870 degrees C (7 hr), cooling with furnace plus normalizing at 870 degrees C (70 min), cooling in air plus quenching from 850 degrees C (40 min) in oil. Following this treatment specimens of the steel were subjected to mechanical tests at room temperature. Author (TAB)

N70-11571# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AN INVESTIGATION OF THE DAMPING PROPERTIES OF SOME REFRACTORY MATERIALS AT HIGH TEMPERATURES OF VACUUM

G. S. Pysarenko et al 14 Jul. 1969 5 p refs Transl. into ENGLISH from Dopivodi Akad. Nauk Uk. RSR (Kiev), no. 11, 1966 p 1417 - 1422

(AD-693497; FTD-HT-23-998-68) Avail: CFSTI CSCL 11/6

The damping behavior of as-rolled and annealed (1173K for 1 hr) sintered molybdenum, arc-melted niobium, and sintered tungsten. Flat specimens were subjected to vibrations under a stress varying from 200-300 mm/m (superscript 2) in a vacuum at 293-1500K and in air at 293K. The logarithmic decrement of vibrations was used as a criterion of the damping ability. In all the tested materials and at all test temperatures, the decrement increased with increasing stress. The decrement of the tested metals, except molybdenum in the as-rolled condition, increased with increasing test temperature. For almost all the tested metals in the entire range of test temperatures, the values of the decrement on heating differed from those on cooling. At 273K, the damping properties of metals before heating were, as a rule, slightly higher than after heating. The magnitudes of the decrement in vacuum and in air at 273K differed by 6-8 percent, with the difference decreasing as the decrement increased. At all test temperatures, refractory metals had a higher decrement of vibrations than the most heat-resistant nickel-base alloys. Satisfactory damping properties combined with a high endurance limit (as compared with heat-resistant alloys) in the wide temperature range make promising structural materials in various fields of modern industry.

Author (TAB)

N70-11621# Army Foreign Science and Technology Center, Washington, D.C.

NON-DESTRUCTIVE DETERMINATION OF MECHANICAL PROPERTIES OF METALS

M. S. Drodz 1969 234 p refs Transl. into ENGLISH from the Russian

(AD-692648; FSTC-HT-23-554-68) Avail: CFSTI CSCL 14/2

This book describes the essential features, properties, methods of determination and opportunities for the practical use of a new hardness number developed by the author and determined by a ball test. Correlations observed in measurements of hardness are explored, along with the relationship between metal hardness and its chief mechanical properties. The method of determining mechanical properties of a material without destroying it described in the book can be applied in quality control. Author (TAB)

N70-11851# Army Foreign Science and Technology Center, Washington, D.C.

MECHANICAL PROPERTIES OF ALUMINUM ALLOYS AT LOW TEMPERATURES

P. F. Koshelev et al Jul. 1969 17 p refs Transl. into ENGLISH from Mashinostr. (Kiev), no. 6, 1968 p 86 - 94

(AD-693427; FSTC-HT-23-245-69) Avail: CFSTI CSCL 11/6

The mechanical properties of these alloys at low temperatures have been studied quite fully at the present time. However, there are some areas of omission in estimation of their design strength that is associated with behavior in the presence of stress concentrators, the effect of chemical composition and heat treatment, the scale effect, and also associated with the strength of welds. In this study, the following were investigated: the AK8 alloy of the Al-Cu-Mg system heat treated under two regimes, the V92ts alloy of the Al-Zn-Mg system of varied chemical composition heat treated also under two regimes, the D20 alloy of the Al-Cu-Mn system and its analog grade 2219 with the addition of zirconium and vanadium, and also sintered aluminum powder of grade SAP-1. Also studied were aluminum cast alloys of grades AL4, AL8M, AL27-1, AI19, and ATsMG, prepared in an electric furnace in a 20-30 kg capacity graphite crucible. (Author). TAB

N70-11697# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

IMPACT THERMOMECHANICAL QUENCHING OF ALUMINUM ALLOYS

O. I. Andreeva 17 Jul. 1969 7 p refs Transl. from Akust. i Magnitn. Obrabotka Veshchestv (Russian), 1966 p 117 - 120

(AD-693524; FTD-HT-23-319-68) Avail: CFSTI CSCL 11/6

The effect of hydraulic shock and mechanical vibrations in the process of melting of the alloys D1 and V95 on their mechanical properties was investigated. It was established that following their impulsive thermomechanical quenching the hardness of specimens of these alloys is higher than that of control specimens. Author (TAB)

N70-11710# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE COMPATIBILITY OF SINTERED ALUMINUM POWDER (SAP) MATERIAL WITH ORGANIC HEAT CARRIERS

E. Ya. Bazurina et al 6 Jun. 1969 6 p refs Transl. into ENGLISH from Alyumin. Splavy (Moscow), no. 5, 1967 p 144 - 148

(AD-693602; FTD-HT-23-1352-68) Avail: CFSTI CSCL 11/4

Studies are carried out to demonstrate the high corrosion stability of cermet sintered aluminum powder SAP-1 and SAP-2 materials in such organic heat carriers as monoisopropyldipnenyl and hydrostabilized gas oil, at temperatures of 329 and 300 degrees Centigrade after 1000 h of aging. Addition of distilled water (0.5 to 0.7 percent by volume) has no significant effect on stability under static conditions, nor under the conditions of a heat-carrier stream. Use of AMg6 alloy as welding material for the welding of SAP-1 is inferior to AMn alloy because of the formation of a film of magnesium oxide on the surface. TAB

N70-11739*# Dow Chemical Co., Midland, Mich.

R AND D EVALUATION OF A LIGHTWEIGHT, HIGH STRENGTH MAGNESIUM ALLOY Quarterly Report, 1 May - 1 Aug. 1969

George S. Foerster 1 Aug. 1969 16 p

(Contract NAS5-10398)

(NASA-CR-106973; QR-8) Avail: CFSTI CSCL 11F

The evaluation of Mg-30Sc has been completed. The extrusion of this alloy in the F temper had an excellent combination of properties with but one exception. It is stronger, tougher, stiffer (high modulus), and more cold formable than any other Mg alloy yet discovered. At elevated temperatures it is as strong and creep resistant as Mg - Th and may be heat treated to provide even better properties. The exception to this list of properties is poor resistance to stress corrosion. The search for a Mg - Sc ternary with high strength and low Sc content led to the selection of Mg - 10Sc - 5Li for evaluation on a normal laboratory scale. The CYS (51 ksi) of the 1/16 in. times 7/8 in. extrusion of this alloy

in the T6 temper duplicated that obtained with 1/8 in. dia. wire in the mini-scale evaluation, but its TYS was found to be only 40 ksi. The Mg–15Sc–4Li was selected as the second ternary for evaluation because its higher Sc content and lower Li content provide higher strength (65 ksi CYS) and should provide better creep resistance. Author

N70-11772# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF COLD DEFORMATION ON THE PROPERTIES AND STRUCTURE OF SHEETS OF SINTERED ALUMINUM POWDER SAP
A. A. Vorobev et al 6 Jun. 1969 5 p refs Transl. into ENGLISH from Alyumin. Splavy (USSR), no. 5, 1967 p 217–222
(AD-693510; FTD-HT-23-1345-68) Avail: CFSTI CSCL 11/4

Sintered aluminum, powder SAP material is considerably strengthened in cold deformation by cold hardening of the aluminum matrix. Material relaxation with simultaneous increase in plastic properties results from heating to a temperature above 600 degrees C. Recrystallization through process annealing is observed after exposure of 0.5-1.0 h; with an increase in exposure time, material properties barely change. High-temperature annealing (650 degrees C) sharply increases tensile characteristics at elevated temperatures. After exposure of more than 1.0 h polygonization begins in the material and structure changes. TAB

N70-11808# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANICAL PROPERTIES OF STEEL AT LOW TEMPERATURES, VOLUME 2 [MEKHANICHESKIE SVOISTVA STALI PRINIZKIKH TEMPERATURAKH]
S. I. Gudkov 9 Jun. 1969 158 p refs Transl. into ENGLISH from the Russian
(AD-693278; FTD-HT-23-624-68-Vol-2) Avail: CFSTI CSCL 11/6

The volume presents information on the mechanical and physical properties of the most widely used high-alloy stainless steels at temperatures of liquid oxygen, nitrogen and hydrogen. TAB

N70-11807# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANICAL PROPERTIES OF STEEL AT LOW TEMPERATURES, VOLUME 1 [MEKHANICHESKIE SVOISTVA STALI PRINIZKIKH TEMPERATURAKH]
S. I. Gudkov 9 Jun. 1969 376 p Transl. into ENGLISH from the Russian
(AD-693538; FTD-HT-23-624-68-Vol-1) Avail: CFSTI CSCL 11/6

Information about the physicomechanical properties of basic structural steels in the temperature range plus 20 to minus 253 degrees C is given and the fields of application of various steel are indicated. For every steel grade mark are given tables of physicomechanical properties at subzero temperatures, and, in many cases, the curves point out the effect of technological, structural and exploitation factors on steel strength. Author (TAB)

N70-11811# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH-TEMPERATURE AGING NICKEL AND IRON BASED ALLOYS
M. V. Pridantsev 10 Jul. 1969 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metal. (Moscow), no. 5, 1967 p 115–124
(AD-693458; FTD-HT-23-1358-68) Avail: CFSTI CSCL 11/6

Alloys of this kind began to be investigated in 1945-1946 in view of their applications to the development of aviation gas-turbine engineering. In this connection, the article surveys the principal results of the pertinent R+D work. Thus research into the effect of treatment with alloy elements on high-temperature alloys of the Kh20N80 and Kh15N35 types has made it possible to elucidate the effect of alloy elements displaying varying and variable solubility. High-temperature strength of these alloys is greatly affected by readily fusible impurities which enhance the adverse properties of grain boundaries. This can be offset and the grain boundaries can be toughened not only by using purer alloys but also by adding small amounts of chemically active alkali-earth, rare-earth metals, boron, etc. The vacuum arc and electroslag melting methods have recently been employed on an increasingly broader scale in the production of high-temperature alloys. Author (TAB)

N70-11820# Stanford Univ., Calif. Dept. of Materials Science.
STRUCTURE DEPENDENCE OF HIGH TEMPERATURE DEFORMATION OF METALS Progress Report, 1 Mar. 1968–1 Mar. 1969
Craig R. Barrett and William D. Nix Mar. 1969 42 p refs
(Contract AT(04-3)-326)
(SU-326-P-17-36) Avail: CFSTI

Experiments on shock loading effects on creep of Ni-20 Cr-4.5 Al alloy are reported in which data were fathered that indicate creep strengthening by shock loading is technically feasible. Results of investigations concerned with the theoretical aspects of creep structural dependence are discussed including the structure dependence of Newtonian deformation in metals. Data are included on creep of Ni-20 Cr-4.5 Al alloys and creep of Ni-6%W alloys. NSA

N70-11861# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POWDER ALLOYS OF ALUMINUM WITH SLIGHTLY SOLUBLE ADDITIVES
I. N. Fridlyander et al 6 Jun. 1969 5 p refs Transl. into ENGLISH from Alyumin. Splavy (Moscow), no. 5, 1967 p 226–230
(AD-693511; FTD-HT-23-1350-68) Avail: CFSTI CSCL 11/6

Powder alloys of aluminum with chromium and iron are produced by the spraying method, with strips pressed from these alloys to dimensions of 45 by 10 mm. At room and elevated temperatures the structural and mechanical properties of the powder alloys were studied and x-ray structural and phase analyses carried out. It is demonstrated that spraying is an effective method of hardening alloys from the liquid state to produce highly supersaturated solid solutions. TAB

N70-11997# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESEARCH ON THE METALLURGY, CHEMISTRY AND ELECTROCHEMISTRY OF TITANIUM
V. A. Reznichenko 23 Jun. 1969 12 p refs Transl. into ENGLISH from Ssr. Izv. Metally (USSR), issue 5, 1967 p 43–57
(Contract F33657-68-D-0865IP002)
(AD-693482; FTD-HT-23-1357-68) Avail: CFSTI CSCL 11/6

A survey of past and present Soviet research into the metallurgy, chemistry and electrochemistry of titanium is presented. The studies of the electrochemistry of titanium ores have made it possible to separate metals during the processing of Fe-Ti-V, Fe-Ti-Nb-rare metal ores and thus provide a workable basis for an efficient mass-scale comprehensive recovery of metals from complex titanium ores. These studies also have resulted in confirming the sorption mechanism of the reduction of iron titanates and developing and introducing the technology of melting of high-titanium alloys. In recent years Soviet industry has made major advances in developing the technology and equipment for the chlorination of titanium and the condensation and purification of titanium chloride. The potential inherent in the chlorine method of the production of titanium dioxide pigment as compared with the classical sulfuric acid method, is pointed out. The studies dealing with the

electrochemistry of titanium in molten media chiefly pertain to research into the processes of the electrochemical reduction of titanium compounds in molten media. Author (TAB)

N70-12028*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

SOME FACTORS AFFECTING THE STRESS-CORROSION CRACKING OF Ti-6Al-4V ALLOY IN METHANOL

W. Barry Lisagor Washington Dec. 1969 44 p refs

(NASA-TN-D-5557) Avail: CFSTI CSCL 11F

The results of an investigation of factors affecting the stress-corrosion cracking of Ti-6Al-4V alloy in methanol are presented. Both self-stressed and precracked specimens were tested; for the precracked specimens, the analysis was based on fracture mechanics theory. The investigation included the effects of heat treatment, chloride ion content, and presence of initial flaws introduced as fatigue cracks in test specimens. Materials in three heat-treated conditions were included, and chloride ion content varied from 5 to 500 ppm added to the methanol as concentrated hydrochloric acid. Stress levels from 25 to 100 ksi (170 to 690 MN/m2) were used for self-stressed specimen tests, and initial stress intensities from approximately 4 ksi (in.) to the 1/2 power (4.4 MN/m2 (m) to the 1/2 power) to the critical value were used for precracked specimen tests. Comparison of the variables in the study with respect to self-stressed and precracked specimen testing were made to determine whether environmental effects were more critical during the early or final stages of exposure. Author

N70-12037# IIT Research Inst., Chicago, Ill.

RESEARCH OF ZIRCALOY BRAZE ALLOY DEVELOPMENT Quarterly Report, 1 Oct. - 31 Dec. 1968

17 Jan. 1969 21 p refs Prepared under US-Euratom Joint Res. and Develop. Program

(Contract AT(11-1)-578)

(IITRI-578-P-32; EURAEC-2086) Avail: CFSTI

The fourth and final exposure period in the corrosion loop with lithium hydroxide for pH control was completed, and the specimens have been received for examination. Specimens removed from the third hydrodynamic exposure period have been fully evaluated for corrosion and mechanical properties. In view of the program timing, a decision has been made to select candidate alloys for exposure in the corrosion loop with ammonium hydroxide for pH control, on the basis of the completed corrosion and tensile evaluations. Seventeen alloys have been chosen, and 10 specimens are being prepared with each alloy. A satisfying number of alloys have promising corrosion and mechanical strength data. The selection is, however, subjective and anomalous and results have not been used for the basis of candidate alloy rejection. A full examination of specimens exposed for the fourth period will be made shortly and will clarify the final alloy selection. Adjustments will be made to the alloy selection, where necessary, for inclusion in the final hydrodynamic loop test. Author (NSA)

N70-12038# Minnesota Univ., Minneapolis. Inst. of Technology.

DIFFUSION STUDIES IN LIQUID METALS Progress Report

R. A. Swalin 15 Jun. 1969 7 p refs

(Contract AT(11-1)-841)

(COO-841-18) Avail: CFSTI

Research progress is reported on determination of radial distribution function in alkali metals, mechanisms of thermotransport in silver alloys, self-diffusion of substances at constant volume, and diffusion of solutes in Ag. NSA

N70-12068*# Lehigh Univ., Bethlehem, Pa.

INVESTIGATION OF THE SOLIDIFICATION, STRUCTURE AND PROPERTIES OF EUTECTIC ALLOYS INCLUDING CONSIDERATION OF PROPERTIES CONTROL Progress Report

R. W. Kraft and R. W. Hertzberg Nov. 1969 17 p refs

(Grant NGL-39-007-007)

(NASA-CR-106838) Avail: CFSTI CSCL 11F

Solidification properties and the mechanical response in a Ni - Ni3Nb eutectic alloy and a eutectic composite were investigated. It was found that vertically aligned ingots grown at 4.7 cm/hr were the most suitable for the preparation of mechanical test coupons. Two additional variants of twinning were determined in the deformation behavior of the reinforcing Ni3Nb phase. The ductility of the vertically grown Ni - Ni3Nb eutectic composite was 500% greater, although the reduction of the cross-sectional area remained about the same; yielding and fracture occurred at the same nominal stress level qualifying the specimen as elastic - plastic material. Fracture and fatigue mechanisms are reported for both the eutectic composite and alloy. A unidirectionally solidified Mg - Mg2Ni eutectic alloy was prepared and tested. M.H.E.

N70-12077# Joint Publications Research Service, Washington, D.C.

SELECTIONS FROM SOVIET METALS JOURNAL, NO. 4, 1969

9 Oct. 1969 18 p refs Transl. into ENGLISH from Izv. Akad. Nauk. SSSR, Metal. (Moscow), No. 4, 1969 p 97 - 100 and 268 - 271

Avail: CFSTI

CONTENTS:

1. BASIC CONCEPT OF THE PLASTIC DEFORMATION OF METALS IN A VACUUM T. M. Pavlov p 1 - 6 refs (See N70-12078 02-17)

2. THE INTERACTION OF TANTALUM AND HYDROGEN AT HIGH TEMPERATURES A. A. Mazayev et al p 7 - 11 refs (See N70-12079 02-17)

3. THIRD ALL-UNION CONFERENCE ON THE PREPARATION, STRUCTURE, PHYSICAL PROPERTIES AND APPLICATIONS OF SINGLE CRYSTALS OF HIGH MELTING AND RARE METALS Ye. V. Ottonberg p 16 - 18 refs (See N70-12080 02-17)

N70-12078# Joint Publications Research Service, Washington, D.C.

BASIC CONCEPT OF THE PLASTIC DEFORMATION OF METALS IN A VACUUM

T. M. Pavlov *In its* Selections from Soviet Metals J., No. 4, 1969 9 Oct. 1969 p 1 - 6 refs (See N70-12077 02-17)

Avail: CFSTI

The preliminary effects of vacuum processing on metal surfaces, oxides, lubricants, and the operating equipment are cited as the cause of processing problems prior to plastic deformation during vacuum treatment under pressure. Intensive changes in the state of the metal, which occur at the source of the deformation, cause differences in post-vacuum and vacuum deformation states. Changes in gaseous states in the metal, and the generation of residual stresses in the metal are significant; both are associated with sharp transitions from vacuum to high pressure and vice versa. Basic nonvacuum equipment in a medium of pure inert gas is suggested for the operating equipment, with vacuum equipment and devices employed only in preliminary and subsequent stages of processing. M.H.E.

N70-12079# Joint Publications Research Service, Washington, D.C.

THE INTERACTION OF TANTALUM AND HYDROGEN AT HIGH TEMPERATURES

A. A. Mazayev et al *In its* Selections from Soviet Metals J., No.

4, 1969 9 Oct. 1969 p 7–11 refs (See N70-12077 02-17)
Avail: CFSTI

Solubility relationships of hydrogen in tantalum were determined within the temperature range of 1373 to 2973 K with pressures up to 100 atmospheres. The results show that hydrogen solubility in tantalum falls exponentially with an increase in temperature when the pressure is constant, and is proportional to the square root of the pressure. Two equations are given which describe the solubility relationship and predict the results of the experimental data with an accuracy of + or – 10%. M.H.E.

N70-12080# Joint Publications Research Service, Washington, D.C.

THIRD ALL-UNION CONFERENCE ON THE PREPARATION, STRUCTURE, PHYSICAL PROPERTIES AND APPLICATIONS OF SINGLE CRYSTALS OF HIGH MELTING AND RARE METALS

Ye. V. Ottonberg *In its* Selections from Soviet Metals J., No. 4, 1969 9 Oct. 1969 p 12–16 refs (See N70-12077 02-17)
Avail: CFSTI

Papers on methods of growing monocrystals, the investigation of the growth mechanism and the distribution of impurities during the process of melting are noted. Investigations of monocrystal structure and properties of high melting and rare metals and their alloys, and the emission properties of monocrystals are cited. Works on the influence of external factors (deformation, annealing, irradiation, and heat cycling) on monocrystalline structure and properties are also cited. The conference recommended that research institutes expand work on: (1) the development of the technology for high purity metal production, (2) the investigation of the growth mechanism of metal crystals, (3) quantitative evaluation of the content of impurities and defects in metal crystals, and (4) investigation of the structure and properties of monocrystals, alloys, and metal compounds, and the determination of their constants. M.H.E.

N70-12196# Technische Hochschule, Darmstadt (West Germany). Inst. für Werkstoffkunde.

INVESTIGATION OF THE LONG TERM STRENGTH OF HARD CHROMIUM PLATED, SMOOTH OR NOTCHED STEEL SAMPLES: EVALUATION METHODS FOR THE PRESENTATION OF THE EXPERIMENTAL RESULTS [UNTERSUCHUNGEN UEBER DAS DAUERFESTIGKEITSVERHALTEN HARTVERCHROMTER GLATTER UND GEKERBTER STAHLPROBEN: AUSWERTUNGSMETHODEN ZUR DARSTELLUNG DER VERSUCHSERGEBNISSE]

Udo-Horst Fürstenberg (Ph.D. Thesis) 1968 128 p refs In GERMAN Sponsored by Forsch. Ver. Verbrennungskraftmaschinen and Bundeswirtschaftsmin.
Avail: CFSTI

The optimum conditions for depositing hard chromium coatings on steel samples are determined and the mechanical properties of the samples tested. Single and composite coatings were used, and notch strength tests were conducted under cyclic loading by rotating the samples. The creep strength was determined both of smooth and notched samples, using the coating thickness as a parameter. Conclusions are drawn as to the applications of these results to practical engineering. ESRO

N70-12256# Atomic Energy Commission Research Establishment, Risö (Denmark). Metallurgy Dept.

METALLURGY DEPARTMENT Annual Progress Report, 1 Apr. 1968 – 31 Mar. 1969

May 1969 40 p refs
(RISO-199) Avail: CFSTI

A report on the research work in the Metallurgy Department at Risö covering the period April 1968–1969 is presented. Research work in reactor metallurgy was centered on problems connected with fuel elements and steel pressure vessels. Corrosion tests have been carried out on advanced zirconium alloys and on the distribution of intermetallics in surface corrosion films. Research concerning uranium dioxide includes the relationship between powder characteristics and pressing and sintering behavior. The steel program includes irradiation of high-strength reactor pressure vessel steels. In the field of general material research the strength-structure relations for single phase and two-phase materials have been investigated. ESRO

N70-12329# Mechanical Properties Data Center, Traverse City, Mich.

TENSILE FRACTURE TOUGHNESS

Aug. 1969 22 p
(AD-693655; Rept-661) Avail: CFSTI CSCL 11/6

A tabulation is presented of an inventory of the tensile fracture toughness data currently stored in the automated storage file of the Mechanical Properties Data Center. The values here indicate the quantity of results tested specimens, for each combination of alloy, temperature and toughness index, that are available in response to inquiries on tensile fracture toughness. In addition to the measured property values, information on test environment, material condition, material from and test procedures are stored to supplement and define the test results. Author (TAB)

N70-12346# Krupp (Fried.) G.m.g.H., Rheinhausen (West Germany). Metallurgische Abteilung, Huettenwerke.

TEMPERATURE VARIATION IN KILLED STEEL INGOTS DURING SOLIDIFICATION, COOLING AND REHEATING IN THE SOAKING PIT FURNACE [TEMPERATURVERLAUF IN BERUHIGT VERGOSSENEN STAHLBLOECKEN WAEHREND DER ERSTARRUNG, ABKUEHLUNG UND WIEDERERWAERMUNG IM TIEFOFEN]

Klaus Müller (Ph.D. Thesis–Clausthal Univ., 1967), P. Hammerschmid, and P. Funke, Jr. *In its* Krupp Tech. Inform. Res. Rept., Vol. 27, No. May 1969 p 13–26 refs In GERMAN; ENGLISH summary (See N70-12343 02-34)
Avail: CFSTI

The temperature variation in the steel rising in the mould during solidification and cooling is measured and the solidification process across the ingot section examined. The relationship between the temperature of the ingots when placed into the furnace and the temperature of the furnace itself is studied, and the temperature variation of the ingots during heating in the furnace is determined. From this data, it can be decided when to strip the ingot and the heating times required in the furnace. Author (ESRO)

N70-12352# Krupp (Fried.) G.m.b.H., Essen (West Germany). Industriebau und Maschinenfabriken.

ELECTRO-EROSION AND ELECTROLYTICAL MACHINING PROCESSES [ELEKTROEROSIVE UND ELEKTROCHEMISCHE BEARBEITUNGSVERFAHREN]

A. Winkelmann *In its* Krupp Tech. Inform. Engr. Rept., Vol. 27, No. 2 Jun. 1969 p 53–68 refs In GERMAN; ENGLISH summary (See N70-12351 02-34)
Avail: CFSTI

Spark and electrochemical machining have gained importance not only in tool and form making, but also in quantity production. A survey is given on the state-of-the-art of both methods. In particular, pulse generators, industrial production machine design, working speed and electrode wear, relations between material and electrode substances, and different production processes are discussed. Author (ESRO)

N70-12382# Utah Univ., Salt Lake City. Dept. of Mineral Engineering.

THE RECRYSTALLIZATION KINETICS OF MAGNESIUM

CONTAINING SMALL AMOUNTS OF IMPURITY ELEMENTS, GRAIN GROWTH OF DILUTE ALLOYS OF MAGNESIUM AND ELECTRON MICROSCOPY OF THE DUCTILE BRITTLE TRANSITION IN CHROMIUM Final Scientific Report

Charles H. Pitt, Theron G. Odekirk, William J. Hong, and H. S. Shim Jul. 1969 118 p refs

(Grant AF-AFOSR-39-67)

(AD-693238; AFOSR-69-2194TR) Avail: CFSTI CSCL 20/2

Experimental work has been carried out to determine the recrystallization kinetics of magnesium-cadmium and magnesium-zirconium dilute alloys. A theory has been developed to explain the linear variation of per cent recrystallization with log time as observed in these alloys. Measurements of normal grain growth was made in magnesium-zinc and magnesium-manganese alloys and was found to obey the normal grain growth law, D squared = kt. The mechanism for grain growth was found to be a single step process with an activation energy of 18 kilocalories per mole. Preliminary work was accomplished in preparing specimens and building apparatus for low temperature testing of pure chromium tensile specimens. Author (TAB)

N70-12448# Brookhaven National Lab., Upton, N.Y.

CONTROL OF SURFACE CONTOUR AND SMOOTHNESS ON IRON ELECTRON-TRANSMISSION SPECIMENS

Joseph S. Bryner [1968] 20 p refs Sponsored by AEC

(BNL-13829) Avail: CFSTI

A method is described for reliable production of abundant, smooth, strain-free electron-transparent metal in iron specimens up to 0.3 mm thick in a single operation at ambient temperature. Smoothness is controlled by the electrolytic potential and the modified composition of the chromic-acetic acid electrolyte. Surface contour is controlled by adjusting the spacing between the specimen and the cathodes and revolving both specimen and cathodes in a circular orbit parallel to the specimen faces. Limiting the electrolytic current to exposed areas on the specimen faces through use of an anodized tantalum specimen holder obviates the necessity for cooling and permits detection of a self-indicating end point. The method yields satisfactory results on iron-, nickel-, and cobalt-base alloys. Author (NSA)

N70-12454*# Tyco Labs., Inc., Waltham, Mass.

STUDY OF THE GENERAL MECHANISM OF STRESS CORROSION OF ALUMINUM ALLOYS AND DEVELOPMENT OF TECHNIQUES FOR ITS DETECTION Quarterly Report, 1 Sep. - 30 Nov. 1968

S. B. Brummer, R. O. Bell, F. H. Cocks, and A. Cordellos 30 Nov. 1968 65 p refs

(Contract NAS8-20297)

(NASA-CR-102343; QR-8) Avail: CFSTI CSCL 11F

The objectives of this investigation are to examine the mechanism of the stress corrosion cracking of Al alloys and to study the feasibility of using instrumental methods to detect stress corrosion cracking on fabricated Al alloy parts. The study was implemented by means of four subprojects: (1) to determine the effects of environment on the mode and rate of cracking of Al-Zn-Mg-(Cu) and Al-Cu, (2) to establish the mechanism of precorrosion effect, (3) to examine oxide rupture on Al alloys in order to establish their local deformability, and (4) to apply metallography and electron microscopy where appropriate. The effect of temperature on the stress corrosion life of 7075-T651 was investigated. Studies were made in 1M NaCl buffered to pH 4.7. Stress corrosion was carried out galvanostatically at 90% of the preparation of the alloy. Electropolished samples fail much more readily at all temperatures than samples with an as-machined finish. This difference is associated with the precorrosion effect noted previously and discussed below. Failure time for the electropolished samples decreased with increase in temperature. For as-machined samples, failure time increased by a factor of 5 between 30 and 50 C and subsequently decreased by a factor of 10 between 50 and 70 C. The unexpected behavior of the as-machined surfaces is interpreted in terms of a change in the degree of localization of corrosive attack with temperature. Author

N70-12480# Battelle-Northwest, Richland, Wash. Metallurgy and Ceramics Dept.

DISLOCATION-SUBSTRUCTURE INTERACTIONS IN IRRADIATED IRON AND STEEL

F. A. Smidt, Jr. Jun. 1969 73 p Jun. 1969 73 p refs

(Contract AT(45-1)-1830)

(BNWL-1045) Avail: CFSTI

The influence of radiation damage upon the mechanical properties of iron and steel are analyzed in terms of the substructure of defect aggregates produced by irradiation, the interaction of dislocations with the substructure, and the implications of these interactions on the macroscopic mechanical properties. An analysis of the most probable dislocation-defect interactions leads to the conclusion that the defects, while not influencing the short range forces controlling thermally activated processes in bcc metals, do interact strongly as long range forces affecting the athermal processes. An estimate of the increase in strength from observed defect sizes and densities indicates the increase in strength approaches that were predicted by the Orowan theory of precipitation hardening. Transmission electron microscopy observations, however, have shown that the defects are destroyed by moving dislocations. Author (NSA)

N70-12491# United Kingdom Atomic Energy Authority, Risley (England). Safeguards Div.

RECOMMENDATIONS ON THE SAFE HANDLING OF ZIRCONIUM METAL AND ZIRCONIUM ALLOYS

G. H. Bulmer 1969 51 p refs Revised

(AHSB(S)R-167) Avail: HMSO 8s; BIS $1.60; CFSTI

Revised recommendations on the safe handling of zirconium metal and zirconium alloys are presented. Following a summary of the physical, chemical and toxic properties of zirconium, the design features necessary to ensure an adequate safety standard in the construction and installation of plant in process areas, and in laboratories and stores are given. Where appropriate statutory and nonstatutory regulations are quoted and used as a framework for specifying operational safety requirements for both normal and accident conditions. Special conditions applicable to the storage and disposal of unirradiated and irradiated zirconium are given in respect of the several forms of waste likely to be met with, and recommendations are made on transport and containers. Author (NSA)

N70-12533# National Physical Lab., Teddington (England). Div. of Inorganic and Metallic Structure.

INTERFACIAL EFFECTS IN THE ALUMINIUM-SAPPHIRE SYSTEM

J. A. Champion, B. J. Keene, and J. M. Sillwood Sep. 1969 19 p refs

(NPL-IMS-3) Avail: CFSTI

The sessile-drop technique has been used to examine the interfacial effects that occur between molten aluminium and single-crystal alpha-Al2O3 when heated in vacuo at temperatures in the range 700 deg to 1400 deg C. The observed variations with temperature of the contact angle and of the area of interfacial contact support the contention of Brennan and Pask that there is a change in the nature of the Al2O3 surface at about 950 deg C. In the region of 1300 deg C the growth of crystallites, probably of alpha-Al2O3, at the liquid-solid and liquid-vapour interfaces has been observed, together with the formation of etch pits on the sapphire plaque as the result of vapour attack. These effects are described and discussed. Author (ESRO)

N70-12594# Akademiya Nauk URSR, Kiev.
SOME GENERAL REQUIREMENTS FOR THE MEASURING CIRCUITS OF THE IKSIN-2 AND FMI IKSIN-3 DEVICES
M. P. Afanasenko *In its* Methods for Collecting and Process. Inform. 1967 p 162–167 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

In measuring coercive force and the residual and induced magnetization of high strength alloy products, the indicated parameters are determined by magnetometry. The magnetically sensitive element of the devices is a combined magnetically modulated field measuring magnetometer-sensor with dual frequency output, and the measuring unit is constructed on the principle of a two-channel magnetometer. One of the channels is used for measurement and the field measuring channel is especially designed to reduce interference effects. Functions are analyzed which permit selection of the required amplification factor of both amplifier channels of the measuring unit of the device and compensation of external interference by a given acceptable accuracy and instability of the measuring circuit elements. Transl. by R.B.

N70-12595# Akademiya Nauk URSR, Kiev.
AUTOMATIC SORTING OF HIGH STRENGTH ALLOY PRODUCTS BY MAGNETIC METHODS
M. P. Afanasenko *In its* Methods for Collecting and Process. Inform. 1967 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

Magnetometric measurement of coercive force intensity is employed for automatic control in evaluating the quality of high strength alloy products by three groups – 'standard,' 'above-standard,' and 'below-standard.' Tests of a model of the sorting device according to the compensation method show that products can be sorted over a wide range of shapes and sizes into any number of groups with an accuracy of 1.5 to 2 per cent, the processing time for a single item not requiring more than 1 second. Measurement accuracy is not dependent on placing the item in measuring position nor on the shape and dimensions of the control object. In the perturbed field method, the magnetized state of the control item (which has first been magnetized to saturation) is measured after it has been acted upon by a magnetic field intensity such that the item would be demagnetized to zero, assuming its coercive force corresponds to a nominal value. Transl. by R.B.

N70-12609# Battelle-Northwest, Richland, Wash. Metallurgy Development Dept.
YIELD SURFACE OF A URANIUM-7.5 wt PERCENT Nb-2.5 wt PERCENT Zr ALLOY (MULBERRY)
D. D. Hays Aug. 1969 34 p ref
(Contract AT(45-1)-1830)
(BNWL-1112) Avail: CFSTI

The biaxial yield surface of a gamma stabilized uranium – 7.5 wt % Nb – 2.5 wt % Zr alloy (Mulberry) was determined. The yield surface is best described by the maximum strain (Von Mises) theory of yielding. Author (NSA)

N70-12638# Kresge-Hooker Science Library Services, Detroit, Mich.
BREAKAWAY MECHANISM DURING THE CORROSION OF ZIRCONIUM
Georg Ullrich [1969] 13 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 59, 1968 p 292–296
(WAPD-Trans-122) Avail: CFSTI

During the corrosion of zirconium and its alloys in oxygen-containing media at temperatures which induce scale formation, the law of thickness – growth obeys, as a rule, the growth law x(n) = k t, as long as the oxide layer has a protective action. If the coating is lost by cracking of the oxide, deviations appear which follow a linear time law, with extensive destruction of the oxide layers. Regarding the temporal progress of the strain in the oxide, an approach is made which is based on the assumption that the tensile strength in the oxide changes to the extent that the tensile strength in the metal is reduced by relaxation, within the relaxtion time tau sub one. This temporal progress of the stress may be inserted into the formula of the Boltzmann and may be determined by measuring the weight increases of corroding samples with increasing contents of alloys. A differential equation is presented which satisfies the additional strain large sigma sub z. Author (NSA)

N70-12642# California Univ., Livermore. Lawrence Radiation Lab.
SHEARING OF BULK Cu, Be, and W UNDER NEARLY HYDROSTATIC PRESSURES TO 70 KILOBARS
A. E. Abey 11 Jul. 1969 10 p Presented at Intern. Conf. on the Phys. Properties of Solids under Pressure, Grenoble, France, 8–10 Sep. 1969 Submitted for publication Sponsored by AEC
(UCRL-71844; Conf-690908-1) Avail: CFSTI

A new apparatus has been developed to shear bulk metal samples at pressure up to 70 kbar. The apparatus is explained in detail and some data for Cu, Be, and W are presented. Author (NSA)

N70-12647# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
HIGH TEMPERATURE SPECIFIC HEAT OF BODY-CENTERED-CUBIC REFRACTORY METALS
M. Hock (Cincinnati Univ.) 7 Feb. 1969 32 p refs
(Contract AT(40-1)-2847)
(GEMP-696) Avail: CFSTI

High temperature enthalpy data on chromium, niobium, tantalum, rhenium, molybdenum, and tungsten were evaluated taking into consideration higher order anharmonic contributions to the specific heat. It was found that at high temperatures the enthalpy can be expressed. This equation represents the enthalpy and its derivative the specific heat up to within 100 K of the melting point. The equation contains only three coefficients which are determined by experiment. Previous interpretations used an equation which contains five coefficients to be determined by experiment. Accurate enthalpy or specific heat data, close to the melting point, are required for calculation of defect formation energies and concentrations from high temperature enthalpy or specific heat measurements. Author (NSA)

N70-12660# Cornell Univ., Ithaca, N.Y. Materials Science Center.
FAR INFRARED PROPERTIES OF DYSPROSIUM AND TERBIUM METALS
Howard Stephen Marsh (Ph.D. Thesis) Jun. 1969 153 p refs Sponsored in part by ARPA
(Contract AT(30-1)-2391)
(NYO-2391-96; Rept-1142) Avail: CFSTI

The surface impedances of polycrystalline Dy and Tb metals were measured in the far-infrared spectral region from 3 to 30 cm. In a zero magnetic field, the ferromagnetic resonance was observed as a strong, broad peak in the surface resistance, and the frequency of this resonance was studied as a function of temperature from liquid-helium temperature to 153 K. The resonance frequency decreased from 24.4/cm at 4.2 K to 10.5 cm at 80 K in Dy and from 14.6/cm at 4.2 K to 6.4/cm at 153 K in Tb. The values of the uniaxial and hexagonal anistropy constants were deduced from these observations. Magnetoelastic interaction energies were extremely large in Dy and Tb, and the effects of these interactions on the long-wavelength spin-wave energies were considered. The far-infrared results are described by the frozen-lattice model first proposed by Turov and Shavrov and calculated for Dy and Tb by Cooper. Author (NSA)

N70-12683# Krupp (Fried.) G.m.b.H., Essen (West Germany). Schmiede und Giesserei.
QUALITATIVE EVALUATION OF TITANIUM PRODUCTION [QUALITAETSMERKMALE DER TITANPRODUKTION]
A. Gerhardt *In its* Krupp Tech. Inform. Eng. Rept., Vol. 27, No. 1 Feb. 1969 p 1–4 In GERMAN; ENGLISH summary Presented at the Intern. Conf. on Titanium, London, 21–24 May 1969 (See N70-12682 02-34)
Avail: CFSTI

Large size titanium and titanium alloy ingots produced in a vacuum arc furnace up to a weight of 10 tons are investigated as to their homogeneity in impurity content and mechanical properties. It appears that ingots of this size show a sufficiently high quality. Author (ESRO)

N70-12684# Krupp (Fried.) G.m.b.H., Essen (West Germany). Schmiede und Giesserei.
PROPERTIES OF TITANIUM AND ITS APPLICATION IN THE CHEMICAL INDUSTRY [EIGENSCHAFTEN VON TITAN UND ANWENDUNG IN DER CHEMISCHEN INDUSTRIE]
W. Knorr *In its* Krupp Tech. Inform. Eng. Rept., Vol. 27, No. 1 Feb. 1969 p 5–18 refs In GERMAN; ENGLISH summary (See N70-12682 02-34)
Avail: CFSTI

A survey is given of the corrosion behavior of titanium and titanium alloys and some practical cases of stress and fissure corrosion are described. The mechanical properties of pure titanium, its behavior under long term stress, values for strength calculations, and the temperature limits of titanium are discussed. At higher temperatures and stresses titanium alloys or composite titanium-steel materials are used. The production of explosion-formed titanium platings and the properties of this composite material are also described. Author (ESRO)

N70-12685# Krupp (Fried.) G.m.b.H., Essen (West Germany). Zentralinst. für Forschung und Entwicklung.
THE EFFECT OF PALLADIUM ADMIXTURES ON THE CORROSION RESISTANCE OF TITANIUM [DER EINFLUSS DES PALLADIUMZUSATZES AUF DIE KORROSIONSBESTAENDIGKEIT DES TITANS]
W. R. Fischer *In its* Krupp Tech. Inform. Eng. Rept., Vol. 27, No. 1 Feb. 1969 p 19–24 refs In GERMAN; ENGLISH summary (See N70-12682 02-34)
Avail: CFSTI

Palladium alloyed with titanium provides a local-cathode effect and reduces the excess voltage of hydrogen precipitation, thus facilitating the passivation of titanium. The usual content of 0.2% of palladium must be increased for use under difficult operating conditions. The superiority of TiPd alloys concerning corrosion resistance is demonstrated by means of examples. Author (ESRO)

N70-12686# Krupp (Fried.) G.m.b.H., Essen (West Germany). Schmiede und Giesserei.
PROPERTIES AND USES OF TITANIUM ALLOYS [EIGENSCHAFTEN UND ANWENDUNG VON TITANLEGIERUNGEN]
W. Knorr *In its* Krupp Tech. Inform. Engr. Rept., Vol. 27, No. 1 Feb. 1969 p 25–38 refs In GERMAN; ENGLISH summary (See N69-00000 00-34)
Avail: CFSTI

A survey is given of titanium alloys and the properties of practically used alloys. The effects of different alloying metals, metal structure and thermal treatment on the properties both at normal and elevated temperatures are described. Future development of high strength alloys with sufficient deep hardening and high impact strength to be used for forgings and sheet metal are outlined. Applications from German aerospace engineering, automobile engine design, machine tool engineering and precision industry are described. Author (ESRO)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N70-11517# Royal Aircraft Establishment, Farnborough (England).
THE THERMAL STABILITY OF PHENYL CONTAINING SILICONE RUBBERS
Edna Kay Mar. 1969 21 p refs
(AD-693643; RAE-TR-69025) Avail: CFSTI CSCL 11/10

A comparison has been made between the thermal stabilities of phenyl methyl silicone rubbers cross-linked by organic peroxides and by high energy irradiation. The large quantities of peroxide required to produce practical levels of cure, lead to reactions detrimental to heat stability and the resulting vulcanisates offer no advantages over peroxide-cured methyl vinyl polymers. Such undesirable effects can be eliminated by the use of irradiation, which, combined with the superior oxidation resistance provided by the phenyl groups produces an elastomer of outstanding heat stability. Author (TAB)

N70-11527# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INFLUENCE OF A LIQUID MEDIUM ON THE SERVICE LIFE AND THE FRICTION COEFFICIENTS OF LUBRICATING LACQUERS BASED ON MOLYBDENUM DISULFIDE
L. N. Sentyurichina et al 23 May 1969 11 p refs Transl. into ENGLISH from Schmierstoffe und Schmierungstechnik (German), no. 9, 1967 p 74–80
(AD-692640; FTD-HT-23-92-69) Avail: CFSTI CSCL 11/8

The practicality of simultaneously using lubricating lacquers and a liquid lubricant was investigated. Water and oil (viscosity at 50 degrees 4.2 centistokes) were used as liquid phases. The lubricating lacquers were mixed with such adhesives as polysiloxane, urea resins, epoxide, glyptal, and fluorocarbon resins for evaluation in water and oil. Analogous results were obtained in oil. In general, it was found that lubricating lacquers should be used in combination with liquid or plastic lubricants when the sliding rate is below a crit. value of the Stribeck curve, when local high loads act periodically on the lubricant, and when periodically insufficient lubricant is present in the region of friction. Author (TAB)

N70-11542# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF COATING PARTS TO GIVE WEAR RESISTANCE
V. V. Kovalev et al 18 Jun. 1969 3 p Transl. into ENGLISH from Russian Patent no. 210312 (Appl. no. 1097408/23-4, 17 Aug. 1968) 2 p
(AD-693532; FTD-HT-23-135-69) Avail: CFSTI CSCL 11/3

A method is described for coating parts to give antiwear properties. The method includes degreasing, washing with water, phosphating, treating with a composition containing molybdenum disulfide and an alcohol-bakelite-graphite preparation, and finally drying. To obtain a coating of greater strength and to increase the wear resistance of the parts, the treating composition is supplemented with ethyl alcohol and the parts (after drying) are heated to 300-400 degrees C, held at this temperature, then gradually cooled. In another variant of this method the treating composition consists of 80-100 (pts by wt) ethyl alcohol, 2-3 (pts by wt) of the alcohol graphite-bakelite preparation, and 7-8 (pts by wt) molybdenum disulfide. TAB

N70-11548*# Uniroyal, Inc., Mishawaka, Ind. Engineered Systems Dept.
EXPERIMENTAL AND THEORETICAL STUDY FOR DEVELOPMENT OF AN IMPROVED REINFORCED FLEXIBLE WINDOW Final Report, 19 Dec. 1967 - 11 Jul. 1969
Don E. Hile, Jr. 11 Jul. 1969 91 p
(Contract NAS1-7771)
(NASA-CR-66823) Avail: CFSTI CSCL 11D

The objective of this program was to develop an improved flexible transparent space window suitable for use in a flexible expandable space structure. During the course of this contract, a window composite was developed which exhibits superior properties in comparison to earlier constructions. The window construction consists of silicone encapsulated polyether urethane matrix reinforced with a carbon steel rocket cable pattern. The composite exhibits excellent flexibility with an overall thickness of 2.54 mm, pressure resistance to 24.30 nanosecond cm, heat resistance, (150 C for 24 hours), and excellent optical transparency. Author

N70-11613*# Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF A PROTECTIVE COATING SYSTEM FOR REGENERATIVELY COOLED THRUST CHAMBERS Final Technical Report, 1 Jul. 1967 - 31 Mar. 1969
C. G. Ruderer, R. L. Heestand, and D. E. Kizer 31 May 1969 95 p refs
(Contract NAS3-11186)
(NASA-CR-72598) Avail: CFSTI CSCL 11C

Coatings reduce the effective heat flux in regeneratively cooled nozzles. Materials were selected for graded plasma sprayed coatings, including metals, ceramics, and cermets and combinations of these applied as graded coatings. Consideration was given to compatibility of the materials with each other and the rocket environment, thermal conductivity of the coating system, and resistance to spalling as a result of thermal or mechanical shock. Sixteen potential systems were formulated, and on the basis of thermal and stress analyses four systems were selected for fabrication and testing. Four candidate systems were tested in a hydrogen-oxygen rocket motor. On the basis of short duration rocket tests with no cooling of the specimen, one coating system was selected for tests of longer duration employing water cooling. These tests revealed that the coating system (consisting of stainless steel BeO mixtures with an outer layer of thoria) finally selected has the capability of withstanding restarts of the rocket motor but that additional process development is required to obtain optimum deprsits by plasma spraying. Author

N70-11619# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE VISCOELASTIC-PLASTIC CHARACTERISTICS OF POLYMERIC MATERIALS UNDER TRANSVERSE IMPACT
K. A. Kerimov 10 Jul. 1969 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Ser. Tekn. Nauk (Yerevan), v. 20, no. 3/4, 1967 p 185-193
(AD-693597; FTD-HT-23-1218-68) Avail: CFSTI CSCL 20/11

The report is a continuation of earlier work devoted to experimental research on dynamic testing of polymer materials (rubber, caprone, polyvinyl) at relatively low deformation rates (10-15 m/sec.). The present paper is devoted to higher deformation rates, and the author uses in his analysis a model developed by him earlier which accounts simultaneously for the elastic-plastic and viscous properties of the materials. A procedure is described for determining the dynamic characteristics of materials with a polymer structure by replacing the continuous medium with a system having a finite number of degrees of freedom, and two methods are proposed for integrating the equations of motion for such a system by means of an electronic computer and for measuring the tension produced in the fixed end of a sample of this material. By way of an example, the results of the calculations are compared with experimental data on the mechanical properties of fibers made of polyvinyl and of caprone. Author (TAB)

N70-11622# Army Foreign Science and Technology Center, Washington, D.C.
ELECTRICALLY-INSULATING CERAMIC BEADS
19 Jun. 1969 13 p Transl. into ENGLISH from the Russian
(AD-692650; FSTC-HT-23-632-68) Avail: CFSTI CSCL 11/2

The document establishes standards for the manufacture, testing, storage and transportation of ceramic beads used for the electrical insulation of bare wires. Tables are included listing complete dimensions for standard beads of various types. Detailed testing procedures are prescribed which cover both the mechanical and electrical characteristics of the insulating beads. Author (TAB)

N70-11634# Army Weapons Command, Rock Island, Ill. Science and Technology Lab.
ADDITION OF POLYMERS TO GREASES
Joseph M. Bish Jul. 1969 22 p refs
(Contract DA 1G062105A107)
(AD-693257; RIA-69-122) Avail: CFSTI CSCL 11/8

Several polymeric additives were added to a calcium hydroxy stearate grease, a lithium soap grease, and a clay-thickened grease. Maximum extreme-pressure properties occurred when 4 percent (by weight) of polytetrafluoroethylene (PTFE) was added to the calcium hydroxy stearate grease and to the lithium soap grease, and when 7 percent was added to the clay-thickened grease. The addition of a polymer in concentrations from 4 to 7 percent should not adversely affect any of the physical or chemical properties of a grease. A calcium hydroxy stearate grease and a lithium soap grease were prepared containing 4 percent PTFE, and oxidation and corrosion inhibitors. Wear, corrosion, and water-washout tests indicate no harmful effects from the addition of the PTFE; and greatly improved extreme-pressure properties. The addition of a fluorinated ethylene propylene polymer shows a moderate increase in extreme-pressure properties. Author (TAB)

N70-11635# Purdue Univ., Lafayette, Ind.
VISCOELASTIC BEHAVIOR OF A NONLINEAR FIBER REINFORCED PLASTIC
Y. C. Lou and R. A. Schapery Apr. 1969 63 p
(Contract F33615-67-C-1412)
(AD-693654; AFML-TR-69-90-Pt-2) Avail: CFSTI CSCL 11/4

The nonlinear mechanical properties of a unidirectional, glass fiber-epoxy composite at 164F are characterized by using creep and recovery tests together with a constitutive equation based on a thermodynamic theory. The results show that the composite is linearly elastic for the load range studied, but nonlinear viscoelastic behavior is observed for the other orientations. Guided by the nonlinear constitutive equation, the creep and recovery data are plotted on double-logarithmic paper, and the material properties are found by shifting the data to form a master curve for each fiber orientation. Four principal creep compliances are estimated by using the master curves and tensor transformation relations. Finally, we use the nonlinear equation to predict strain response due to multiple-step loading and unloading. The Appendix contains two abstracts of papers which were completed and published during the period covered by this report. Author (TAB)

N70-11647# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE ELECTRIZATION AND RHEOLOGICAL PROPERTIES OF Na LUBRICANT (KONSTALIN)
Yu. F. Deynega et al 5 Jun. 1969 7 p refs Transl. into ENGLISH from Dopividi Akad. Nauk Ukr. (Kiev), no. 7, 1960 p 926-927

(AD-693006; FTD-HT-23-224-68) Avail: CFSTI CSCL 11/8

A comprehensive investigation was made of the kinetics of change in the shearing stress and electrization potential of a sodium lubricant under conditions of transition from elastic deformations through the threshold of strength to a stable flow. It was shown, that the nature of the change in potential and shearing stress substantially depends upon the initial orientation of the structure. Author (TAB)

N70-11655# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF FRICTION CHARACTERISTICS AND WEAR RESISTANCE OF ACRYLIC PLASTICS FOR SLIDE BEARINGS

F. K. Lebedev 17 Jul. 1969 6 p refs Transl. into ENGLISH from Avtomob. Prom. (Moscow), v. 34, no. 9, 1968 p 38

(AD-693504; FTD-HT-23-342-69) Avail: CFSTI CSCL 11/9

Acrylic plastics can be widely used in the form of thin coatings to reduce the wear of friction parts such as bushings, bearings, etc. A high-quality plastic coating is attained by pouring a heated solution of the plastic to a thickness of 0.3-0.5 mm over a finely finished and cleaned metal base. Because acrylic plastics harden at room temperature and lose good bonding characteristics in 10-15 min, the solution prepared is used immediately. To determine the friction and wear resistance, the plastics were tested on a friction machine and under actual operating conditions on an automobile assembly conveyor. Although lubrication improved operating conditions, a limiting temperature is reached at which the plastics break down as though they had not been lubricated. Therefore, a copious and continuous supply of lubricant is needed to keep friction to a minimum and to improve wear resistance. Author (TAB)

N70-11659# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

LUBRICATING PAINT AND LUBRICATING PLASTIC

Chi-t'ing Ko 16 Jul. 1969 4 p Transl. into ENGLISH from K'o Hsueh Hua Pao (Mainland China), no. 3, 1963 p 99

(AD-693599; FTD-HT-23-1308-68) Avail: CFSTI CSCL 11/8

A lubricating paint may be made by adding molybdenum disulfide in oil paint. When molybdenum disulfide is added to plastics, the lubricating property may be built into the plastic. When this plastic is used to make parts, additional lubricants are not needed under low speed and high load conditions. TAB

N70-11660# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FREQUENCY DEPENDENCE OF INTERNAL ENERGY DISSIPATION IN CERTAIN POLYMERIC MATERIALS

Ye. V. Poltoraus 2 Jun. 1969 8 p refs Transl. into ENGLISH from Tr. Rostovsk.-na Donu Inst. Inzh. Zheleznodor. Transp. (Rostov-na-Donu), no. 69, 1967 p 69-74

(AD-693606; FTD-HT-23-51-69) Avail: CFSTI CSCL 20/11

The influence of the frequency of oscillations (6.8-55.1 Hz) on the logarithmic decrement of oscillations of organic glass, caprone, polypropylene, low and high pressure polyethylene, VFT-S and STK-1 glass textolite, glass fiber anisotropic SVAM 10:1 material, and foam plastic PS-4 was investigated. Experiments were carried out using the method of free damped oscillations of cantilever samples during transverse bending deformations. The oscillation frequency was changed by increasing or decreasing the mass of auxiliary attachments which could be securely mounted at the free end of the sample. The oscillation decrement of the majority of the plastics (organic glass, polyethylene, caprone) increases with the decrease in frequency. Experiments carried out using hard plastics-glass textolite and SVAM 10:1 did not exhibit a frequency dependence. Author (TAB)

N70-11667# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHOD OF OBTAINING LUBRICATING GREASE

N. I. Srednikova et al 22 Apr. 1969 5 p Transl. into ENGLISH from Russian Patent no. 201573 (Appl. no. 1076308/23-4, 10 May 1966) 2 p

(AD-693461; FTD-HT-23-1434-68) Avail: CFSTI CSCL 11/8

The method of obtaining lubricating grease by thickening mineral oil with lithium soap of fatty acids is distinguished by the fact that in order to increase the quality of the lubricant, dibutylphthalate is introduced into it in a quantity of 5-10%. Author (TAB)

N70-11711# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STUDY OF TITANIUM CARBIDE COATINGS DEPOSITED ON A STEEL SURFACE

G. A. Semenova et al 9 Jun. 1969 7 p refs Transl. into ENGLISH from the Russian

(AD-693440; FTD-HT-23-1354-68) Avail: CFSTI CSCL11/3

An investigation was made of titanium carbide coatings deposited on the surface of Kh12 (AISI-5117), 08 kp (rimmed), and U8 (AISI-W1) steels at 900-1100 degrees C from a vapor-gas mixture of titanium tetrachloride, benzene, and hydrogen. To obtain the best method of deposition, the relationship between the growing rate of the deposited layer, the composition of the mixture, feeding rate, and the temperature had to be determined. It was found that the deposition rate depended on the consumption of the working mixture and on the feeding of hydrogen up to 0.65 1/min. max. The deposition rate depended on the rate of the chemical reaction. At low concentrations, deposition rate is determined by feeding rate. The deposition rate increased with increasing temperature. The abrasive wear resistance of U8 steel specimens coated with deposited titanium carbide was twice as high as is obtained in coating with sintered titanium carbide at the same hardness. Tests in hydrochloric, sulfuric, and phosphoric acids also showed high corrosion resistance of the deposited layer. Author (TAB)

N70-11726*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Engineering Mechanics Div.

DIELECTRIC CONSTANT AND LOSS TANGENT OF ECCOFOAM PT, AT 2.3 GHz, FOR VARIOUS PACKING DENSITIES

F. L. Lane 1 Dec. 1969 9 p

(Contract NAS7-100)

(NASA-CR-106956; JPL-TR-32-1433) Avail: CFSTI CSCL 11I

The dielectric constant and loss tangent for Eccofoam PT, at various densities, are determined; the resulting density gradients are provided. The range of densities over which the dielectric constant and loss tangent are determined are from approximately 20 to 80 lb/cu ft. Author

N70-11862# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF A PLATING LAYER ON THE CORROSION STABILITY OF SINTERED ALUMINUM POWER (SAP)

V. S. Komissarova et al 6 Jun. 1969 4 p ref Transl. into ENGLISH from Alyumin. Splavy (Moscow), no. 5, 1967 p 223-225

(AD-693530; FTD-HT-23-1349-68) Avail: CFSTI CSCL 11/4

It is demonstrated that AMn alloy cannot be used to plate sintered aluminum powder SAP-1, SAP-2, SAP-3 and SAP-4 materials used under extreme corrosion conditions (sea water, fog) since it intensifies the corrosion. Alloys such as Al plus 5-6 percent Si and Al plus 1 percent Zn cannot be used for plating because of low corrosion stability. The high corrosion stability characteristic of the SAP material is retained only during plating with ADI or

with an aluminum alloy with 0.8-1.0 percent Mg. Pressed SAP-1, SAP-2 and SAP-3 material and sheet SAP-1 material do not exhibit tendency to corrode under tension. TAB

N70-11870# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE INCREASE IN THE STRENGTH OF PRESSED SEMIFINISHED SINTERED ALUMINUM POWDER SAP PRODUCTS

A. A. Norzunov et al 6 Jun. 1969 7 p refs Transl. into ENGLISH from Alyumin. Splavy. Vypusk 5 Konstrukt. Splavy. Sbornik Statey (Moscow), 1967 p 231-238

(Contract F33657-68-D-0865-P002)

(AD-693499; FTD-HT-23-1351-68) Avail: CFSTI CSCL 11/4

The properties of sintered aluminum powder semifinished products within a single grade are determined primarily by the temperature to which the powder is heated prior to briquetting. This temperature reaches an optimum between 680 and 700 degrees Centigrade since it provides for high tensile characteristics, high density and low gas content in conjunction with limited exposure time. An increase in exposure time permits reduction of the temperature range by 80 to 100 degrees. A 10-15 percent reduction in tensile characteristics results from annealing of the hot-pressed sintered aluminum powder briquettes, with a slight increase in relative elongation. TAB

N70-11907*# Stanford Research Inst., Menlo Park, Calif. Chemistry Support Services.

PRELIMINARY EVALUATION OF A THIN ORGANIC FILM COATING Final Report

N. H. G. Daniels and M. C. Garrison 5 Aug. 1969 49 p Prepared for JPL

(Contracts NAS7-100; JPL-951581; SRI Proj. PRD-6063)

(NASA-CR-107018; FR-951581-9) Avail: CFSTI CSCL 11C

Thin siloxane films applied to a metal substrate by electron beam bombardment were tested for resistance to high temperatures and humidities. Tests show that these silicon polymer coatings are generally free from flaws and are well bonded to the steel substrate. The coatings are resistant to cycling between temperatures of 400 and 0 deg F in air. They are not resistant to hot, humid atmospheres, and failed extensively after exposure to an environment of 140 deg F and 100 percent relative humidity. Friction tests at a relatively light load did not reveal any lubricating behavior of the film. Friction coefficients tended to be higher for the coated than for the uncoated areas of the specimens. The coatings suffered damage during a single pass of a rider carrying a load of 89.9 g. at speeds of 0.002 and 0.2 in. min. Author

N70-11923# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ACTIVATION OF SINTERING PROCESSES IN MAGNESIUM OXIDE AND CERTAIN TECHNICAL PRODUCTS ON ITS BASE

V. A. Bron et al 2 Jun. 1969 8 p refs Transl. into ENGLISH from the publ. "Trudy Vsesoyuznoe Soveshchanie po Khimii Okislov Pri Vysokikh Temperaturakh" Leningrad, Izd. Nauka, 1967 p 180-185

(AD-693501; FTD-HT-23-1459-68) Avail: CFSTI CSCL 11/2

The process of sintering low-temperature magnesium obtained from the carbonate or hydrate was investigated and technical products on its basis were studied. With a high degree of dispersion of the magnesium oxide hydrate, intensive sintering is achieved without thermal activation. During isothermal sintering the low-temperature magnesium oxide obtained from the crystalline natural carbonate is intensively sintered in the primary period, characterized by a short time interval. Thermal activation or dispersion will increase the sintering rate. Particular features of the sintering of low-temperature magnesium oxide are caused by the defective structure of the crystalline lattice of periclase, which has increased parameter values. The kinetics of periclase recrystallization and of the process of pore formation as a function of sintering temperature were clarified. It was established that healing of pores during sintering precedes their coalescence; these factors determine the increase in average pore diameter. Intensive sintering of the magnesium oxide hydrate with a high degree of dispersion causes not only fragmenting of brucite crystals but also the formation of a colloidal hydrate which contains the positive ion H(+). Author (TAB)

N70-11985# Picatinny Arsenal, Dover, N.J. Feltman Research Labs.

DEVELOPMENT OF A PYROLYSIS-AIR INFRARED SPECTRUM LIBRARY FOR COMMERCIAL SIZES AND FINISHES USED ON GLASS FIBERS FOR REINFORCED PLASTICS Final Report

Leonard R. Weiner Sep. 1969 14 p refs

(AD-692875; TM-1893) Avail: CFSTI CSCL 11/3

A previously developed technique of pyrolysis Attenuated Total Reflectance (ATR) infrared for fingerprint identification of some glass-fiber surface treatments was extended and expanded to form the nucleus of a spectrum library of all commercially available sizes and finishes used on fibrous glass materials for the reinforced plastics industry. The technique applied in this process is dependent on the organic treatment pyrolysis products being condensed on a multiple internal reflection plate for subsequent recording of an ATR infrared spectrum. While this method of fingerprint identification provided excellent reproducible spectra of organic film formers, it was found that most functional silanes, which are widely used to finish fiberglass products, produce only noncondensable vapors at room temperature. It was this characteristic which precluded the development of a spectrum library for all commercially available surface treatments on glass fibers. Attempts at solvent extraction and pyrolysis gas chromatographic techniques also failed to provide qualitative identification of the functional silane-treated glass cloths studied. Author (TAB)

N70-11995# Texas A&M Univ., College Station. Dept. of Mechanical Engineering.

THE ROTATIONAL TRANSFORMATION OF ELASTIC MODULI FOR FIBER-REINFORCED LAMINAE Final Report

David E. Ellis and H. Richard Thornton Dec. 1968 49 p refs

(Contract N00014-68-A-0140)

(AD-693506; THEMIS-TR-7) Avail: CFSTI CSCL 11/4

The current analysis of thin shells laminated from unidirectional fiber-reinforced laminae is based on knowledge of the elastic properties of individual lamina. The elastic properties of the individual lamina are determined through experimentation. The test data are established for the principal directions of the lamina and a tensor based transformation is used to associate with the coordinate system of the shell. The elastic moduli of the laminate are then obtained by an appropriate consideration of the individual lamina properties. Because components designed using the above analysis have not performed as expected, the assumptions involved are being reviewed in search of a more accurate material characterization procedure. The research effort reported here concerns the applicability of the transformation equations to unidirectional fiber-reinforced laminae. These transformation equations are basic to any design or structural analysis concerning laminated materials other than those exhibiting homogenous, isotropic characteristics. The assumptions in question are homogeniety and plane stress. The transformation equations are derived and analyzed to determine applicability. Thin boron fiber reinforced epoxy orientations, are evaluated and correlated with the applicability analysis to establish the validity of the transformation equations. Author (TAB)

N70-12091# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ABOUT THE RATIONAL USE OF MOTOR OIL ADDITIVES
A. M. Kuliev et al 9 Jun. 1969 18 p refs Transl. into ENGLISH from Vesoyutnoye Soveshch. po Kaimii i Primeniyu Prisadok K Maslam Toplivam, Tr. 2d (Moscow), 1966 p 265–273
(AD-692645; FTD-MT-24-466-68) Avail: CFSTI CSCL 11/8

The interaction of high detergent oils with fine filtration materials is examined. It was found that surface tension can serve as a measure of the concentration of additives in lubricating oils. A unique relationship exists between the surface tension and the detergent properties of oils containing different concentrations of S8-3 additive. The process of absorption on oil filter elements is physical in nature. A formula was derived which permits quantitative evaluation of the amount of absorption of additive in the 28-138 degrees C temperature interval for circulation time of oil in the system from 5-20 hr. The second part of the article deals with the continuous delivery of additives to motor oils. A laboratory device was constructed which permits delivery of oil additive to the oil while the engine is operating. TAB

N70-12242# Institut National de Recherche Chimique Appliquée, Paris (France).
STUDY OF THE INTERFACE GLASS FIBER/PLASTIC MATERIALS Quarterly Progress Report [ETUDE DE L'INTERFACE FIBRE DE VERRE/MATIERE PLASTIQUE Premier Rapport Trimestriel d'Activite]
A. Saint-Yrieix Apr. 1969 66 p refs In FRENCH
(Contract DRME-213/68)
(INRCA-QPR-1) Avail: CFSTI

Adsorption isotherms have been drawn by the front analysis method and the small adsorption cross section implies losses which have to be accounted for. Test measurements have been performed on anatase the cross section of which is sufficient to allow the determination of adsorption isotherm by gravimetric methods. Tests so far carried out have agreed with the point by point chromatographic method. Once checked this theory has been used to draw nC7 and methanol adsorption isotherms on glass fiber. Methanol adsorption appears to be irreversible. Thermal desorption techniques have also been used to reveal the irreversibility of adsorption. It is shown that chromatographic methods are a valuable tool, provided certain operational precautions are observed for use with adsorbents presenting as small cross sections as glass fibres. ESRO

N70-12259# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF PARTICLE SHAPE ON THE ABRASIVENESS OF LAMELLAR SOLIDS
J. P. Giltrow and A. J. Groszek (Brit. Petrol. Company, Ltd.) Feb. 1969 24 p refs
(RAE-TR-69024) Copyright. Avail: CFSTI

The abrasiveness of samples of graphite of controlled shape has been shown to be related to the aspect ratio of the crystallites. A decreasing aspect ratio results in increasing abrasiveness. Whilst the same kind of relationship is valid for MoS2, its more complex surface chemistry does not yet permit the direct calculation of crystal aspect ratios. The effect of particle shape on the abrasiveness of graphite and MoS2 is interpreted mainly in terms of the probability of crystals presenting edge faces to the surfaces in the sliding environment. Author (ESRO)

N70-12296# Oak Ridge National Lab., Tenn.
RADIATION CHEMICAL STUDY OF PLASTICS FOR CHARGED PARTICLE TRACK REGISTRATION. PART A: RADIATION CHEMISTRY OF CELLULOSIC CHARGED PARTICLE TRACK DETECTORS. PART B: POSSIBLE METHODS OF ALPHA PARTICLE TRACK REGISTRATION WITH POLYTETRAFLUOROETHYLENE
D. R. Sears and C. D. Bopp Jul. 1969 35 p refs
(Contract W-7405-eng-26)
(ORNL-4351) Avail: CFSTI

Studies of the radioinduced decomposition of cellulose and cellulose acetate, triacetate, and dinitrate during exposure to low LET gamma photons are reported. Among cellulosic films, pure viscose-regenerated clear cellulose film displayed the most extensive radiation damage, with the formation of CO2 and carbonyl groups. Gaseous products of gamma radiolysis of bulk cellulosics were identified as a function of ester groups, oxygen overpressure, presence of scavenger compound, and other parameters. A decomposition mechanism is proposed involving dehydrogenation of hydroxyl groups in cellulose and deacetylation in cellulose acetates. Some additional experiments that may help to identify processes occurring in actual latent track formation are suggested. Possible methods of registration of alpha particle tracks with polytetrafluorethylene were studied. Author (NSA)

N70-12310*# Ohio State Univ. Research Foundation, Columbus.
PREPARATION OF PIGMENTS FOR SPACE-STABLE THERMAL CONTROL COATINGS Interim Summary Report, 1 Jun. 1968–30 Apr. 1969
W. B. Campbell, J. K. Cochran, J. W. Hinton, J. W. Randall, R. J. Versic et al Jul. 1969 90 p refs
(Contract NAS8-21317)
(NASA-CR-102365) Avail: CFSTI CSCL 11C

The identification and control of vapor phase reaction kinetics to produce pigments by homogeneous nucleation were achieved. A vapor phase apparatus was designed, fabricated, and calibrated through 1500 C. Vapor phase reactions have been analyzed, calculations were made, and powders of alumina, rutile, and zinc orthotitanate (in a mixed phase) were produced by homogeneous nucleation. Electron microscopy shows uniform particle morphology and size. The anticipated advantages of vapor phase homogeneous nucleation (namely, purity, freedom from defects, and uniform particle sizing without grinding) were not disproved. Author

N70-12332# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMBINING LUBRICANTS FOR INTERNAL COMBUSTION ENGINES
I. I. Elovich et al 20 Mar. 1969 243 p refs Transl. into ENGLISH of the publ. "Legirovaniye Smazki Dlya Dvigateley Vnutrennego Sgoraniya" Baku, Izd. AN Azerb. SSR, 1967 p 1–188
(AD-692093; FTD-HT-23-922-68) Avail: CFSTI CSCL 11/8

CONTENTS:

1. TYPES OF MOTOR OILS AND THEIR APPLICATION CONDITIONS p 3–50 refs (See N70-12333 02-18)
2. FUNCTIONAL PROPERTIES OF ADDITIVE-CONTAINING MOTOR OILS p 51–117 refs (See N70-12334 02-18)
3. COMPARATIVE ENGINE CHARACTERISTICS OF OIL PRODUCED FROM AZERBAYDZHAN CRUDE OILS AND WAYS OF IMPROVING THEIR PROPERTIES p 118–235 refs (See N70-12335 02-18)

N70-12333# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TYPES OF MOTOR OILS AND THEIR APPLICATION CONDITIONS
In its Combining Lubricants for Internal Combustion Eng. 20 Mar. 1969 p 3–50a refs (See N70-12332 02-18)
Avail: CFSTI

The influence of oil lubricating properties on the operation of internal combustion engines (ICE) is studied. The manner in which the quality of the oil used in an ICE effects its basic operating indices, and the ways for improving these indices through the quality of the oil by using additives are discussed. Increasing engine

service life, and the influence of motor oil quality on losses due to friction are discussed, and an analysis of operating conditions for principal types of piston ICE under different service conditions is included. F.O.S.

N70-12334# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNCTIONAL PROPERTIES OF ADDITIVE-CONTAINING MOTOR OILS
In its Combining Lubricants for Internal Combustion Eng. 20 Mar. 1969 p 51 – 117c refs (See N70-12332 02-18)
Avail: CFSTI

Experimental data characterizing the most important functional properties of motor oils, especially those containing additives are presented. Tables summarizing detergent properties, oxidation resistance, and chemical composition are included. The effects of metal sulfonates and other additives on the cleansing and detergent properties are discussed. It is concluded that: (1) A rise in temperature inhibits the decrease in viscosity caused by high shear speed of thickened oils. (2) During starting, when the engine is cold and its viscosity is high, the viscosity of polymer-containing oils decreases almost to that of the base oil, and the wear during the first 5 to 10 minutes of cold-engine operation is reduced by a factor of 30 to 60 when thickened oils are used. (3) The temperature and shear speed increase during operation, but the influence of shear speed is reduced at high temperatures. F.O.S.

N70-12335# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPARATIVE ENGINE CHARACTERISTICS OF OIL PRODUCED FROM AZERBAYDZHAN CRUDE OILS AND WAYS OF IMPROVING THEIR PROPERTIES
In its Combining Lubricants for Internal Combustion Eng. 20 Mar. 1969 p 118 - 235 refs (See N70-12332 02-18)
Avail: CFSTI

The improvement of oil and additive production technology, quality control for current production, introduction of new types of raw materials, synthesis and selection of oil additives, and the classification of commercial oils are investigated. Direct engine testing is considered a reliable method for evaluating motor oil service characteristics. The design features and test procedures for using the IT-9 engine for oil tests are described. The engine has a variable compression ratio, regulable heating for incoming oil and air, and spray-cooling system of thermosiphon-evaporator type. These features makes it possible to adjust the engine operation regime; particularly its thermal aspects over a broad range and to hold it within narrow limits. Other test stand engines are described, and results are tabulated. F.O.S.

N70-12336# Institut National de Recherche Chimique Appliquée, Paris (France).
STUDY OF THE INTERFACE GLASS FIBER/PLASTIC MATERIALS Quarterly Progress Report [ETUDE DE L'INTERFACE FIBRE DE VERRE/MATIERE PLASTIQUE Deuxieme Rapport Trimestriel d'Activite]
S. Courtecuisse Jul. 1969 21 p refs In FRENCH
(Contract DRME-213/68)
(INRCA-QPR-2) Avail: CFSTI

The preparation of glass fibers has been analyzed with a view to giving them good adherence properties. Chemical attack on the fibers has been carried out with different acids and for each case the mean percentage of each constituent extracted by the acid has been evaluated as a function of the pH of the acid and the duration of the attack. ESRO

N70-12354# Krupp (Fried.) G.m.b.H., Essen (West Germany). Zentralinstitut. fuer Forschung und Entwicklung.
KRUPP CONTROL SIFTING SYSTEM: A PROCESS FOR CONTROLLING GRINDING MILL PRODUCT FINENESS [KRUPP-KONTROLLSICHTSYSTEM: EIN VERFAHREN ZUR UEBERWACHUNG DER MAHLFEINHEIT]
T. Diener (Krupp (Fried.) G.m.b.H., Rheinhausen) and A. Supp *In its* Krupp Tech. Inform. Eng. Rept., Vol. 27, No. 2 Jun. 1969 p 79-86 In GERMAN; ENGLISH summary (See N70-12351 02-34)
Avail: CFSTI

After discussing different methods to evaluate grain size of grinding products, a system is described which is based on flotation in an air cyclone by means of the centrifugal force acting on the particles. An experimental system has been tested which is to be used in cement production. It is sufficiently sensitive to respond to the variations in grinding fineness occurring during cement production. Author (ESRO)

N70-12430# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
BIBLIOGRAPHY ON THE HIGH TEMPRATURE CHEMISTRY AND PHYSICS OF MATERIALS, JULY SEPTEMBER 1969
J. J. Diamond, ed. Oct. 1969 93 p refs
(NBS-Spec-Publ-315-3) Avail: SOD $1.00

The bibliography consists of references to research involving temperatures above 1000 C. Since this is intended primarily as a current-awareness bibliography, there is no cross-referencing or indexing. This issue contains about 825 references roughly grouped under fifteen subject headings. Author

N70-12446# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Mechanics.
ON THERMAL AND MECHANICAL EFFECTS AT SLIDING INTERFACES Final Report, 1 Feb. 1966 - 28 Feb. 1969
F. F. Ling Apr. 1969 101 p refs Submitted for publication
(Contract AF 33(615)-3378)
(AD-693207; AFML-TR-69-91) Avail: CFSTI CSCL 11/8

This final report concerns investigations on several phases of the project. These are wall effects on non-Newtonian flows, surface displacement on the end of an elastic cylinder, sliding of copper-based sintered material against steel in mineral oil, deformation friction of layered viscoelastic composites, measurement of temperatures due to sliding in vacua, surface temperature transients of rubbing solids, and surface temperatures of layered composites. Author (TAB)

N70-12456*# Monsanto Research Corp., Everett, Mass. Boston Lab.
DEVELOPMENT OF IMPROVED SEMI-ORGANIC STRUCTURAL ADHESIVES FOR ELEVATED TEMPERATURE APPLICATIONS Technical Summary Report, 1 Jul. 1964 - 29 Feb. 1968
John J. O'Connell, Stephen C. Kwan, Elizabeth A. Mc Elhill, Ralph C. Steeves, Michael T. Lehman et al 15 May 1968 209 p
(Contract NAS8-11371)
(NASA-CR-102356; MRB5008) Avail: CFSTI CSCL 11I

An adhesive formulation consisting of a new titanium chelate polymer with silanol substituents, an arylenedisilanol reactive plasticizer, and phenylsilanetriol accelerator was developed that cures in situ in aluminum joints at 170 C to a resin that is in fusible at 250 C. Tensile shear strengths at 250 C of joints bonded with this resin were as high as 780 psi. Several other chelate polymers, including zinc linear polymers and titanium prepolymers with alkoxy, vinyl, or isocyanate substituents, were also developed and tested in adhesive formulations in aluminum joints. New bisbidentate ligands with flexible connecting linkages between 8-hydroxyquinoline or o-alkanoylphenol groups were prepared to improve both tractability and thermal stability of the titanium and zinc chelate polymers. Polychelatotitanosiloxanes based on p-arylenebis(diorganosilanols) cured in situ in aluminum joints produced tensile

shear strengths of 1300 psi at - 100 C and at room temperature. The highest strength obtained at 250 C with this type polymer was 440 psi. Author

N70-12457# United Kingdom Atomic Energy Authority, Wantage, (England) Isotope Research Div.
THE RADIATION POLYMERISATION OF IMPREGNAGED FIBROUS MATERIALS: RECENT DEVELOPMENTS IN THE UNITED KINGDOM
F. R. HILLS, R. L. Barrett, and R. J. Pateman May 1969 40 p refs
(AERE-R-6090) Avail: CFSTI; UK: 6s 0d

The novel properties conferred on timber by impregnation with monomers that are subsequently polymerized by radiation, encouraged the establishment of a wood processing service by the United Kingdom Atomic Energy Authority. The development of this project is described, with particular reference to its first application: moisture-resistant cutlery handles. The present extension of the process to other manufactured items and materials is discussed, together with some longer term objectives. Other experiments designed to characterize the useful properties of wood plastic composites derived from timbers commonly available in the United Kingdom are also reported. Author (NSA)

N70-12565# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
THE THEORY OF PLANE ELASTIC DEFORMATION APPLIED TO THE COMPRESSION OF RUBBER SEALS
F. Edward Ehlers Aug. 1969 34 p ref
(AD-693195; D1-82-0883; Rept-613) Avail: CFSTI CSCL 11/1

The theory of plane elastic deformation as developed by Milne-Thomson utilizing complex variables is explained in detail. Formulas for the displacements and the normal and shear stress in a circular disc are presented in terms of analytic functions of a complex variable. By means of these formulas, an iteration procedure for finding the pressure distribution on a lubricated O ring in a rectangular channel is developed. Since the general form of the pressure distribution on the ring is known, the pressure distribution is first estimated. By means of Fourier analysis, the coefficients for the pressure on the boundary are found; and from these coefficients, the expansions for the displacements on the boundary are calculated. The first estimate of the boundary pressure is then modified to improve the displacements until the ring fits into the rectangular channel. Formulas are derived for the appropriate coefficients in the expansion. Author (TAB)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N70-11419# Nottingham Univ. (England).
THEORY OF NUMBERS Final Technical Report
H. Halberstam and D. R. Woodall Jun. 1969 105 p refs
(Contract DAJA37-68-C-0822)
(AD-693182) Avail: CFSTI CSCL 12/1

The report is divided into 2 distinct parts. Part I is A Conjecture In Prime Number Theory by Prof. Halberstam. Part II is Some Results In Combinatorial Mathematics. Author (TAB)

N70-11429# RAND Corp., Santa Monica, Calif.
ESTIMATION FOR A GENERALIZATION OF THE USUAL LINEAR STATISTICAL MODEL
M. L. Eaton, J. E. Eckles, and C. N. Morris Aug. 1969 40 p refs
(Contract F44620-67-C-0045)
(AD-693120; RM-6078-PR) Avail: CFSTI CSCL 12/1

The Memorandum develops an explicit formula for minimum-variance unbiased linear estimates pertinent to a description of the regression manifold, which is more general than the usual linear model. A review of Gauss-Markov theory, projection theory, and pseudo-inversion, all in a coordinate-free setting, is included at an introductory level. With the results contained in the review, the estimators for the generalized model are quickly and easily developed. Author (TAB)

N70-11445# RAND Corp., Santa Monica, Calif.
CLASSIFICATION OF TIME DEPENDENT OBSERVATIONS
S. P. Azen Aug. 1969 113 p refs
(Contract F44620-67-C-0045)
(AD-692658; R-471-PR) Avail: CFSTI CSCL 12/1

The report provides a discussion of the problem of classifying a series of time-dependent correlated observations into one of several populations. Various procedures are investigated under the assumptions that the time series are approximated by polynomials in t, and that the observations have a special covariance structure. Relative efficiencies of the various procedures are compared. The model is shown to be realistic for applications in certain psychological and physiological measurement problems in which an investigator takes measurements on an individual for classification purposes. Author (TAB)

N70-11458# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
TOPOLOGICAL PROPERTIES OF SETS CONNECTED WITH APPROXIMATION THEORY
Yu. A. Shashkin 15 Aug. 1969 18 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Mat. (Moscow), v. 29, no. 5, 1965 p 1085 - 1094 refs
(Contract NOw-62-0604)
(AD-693364; APL-CLB-3-T-592) Avail: CFSTI CSCL 12/1

The report describes topological properties of polyhedra on which there exist systems of functions of given Chebyshev rank. Calculations are made of the minimum orders of Korovkin systems for one-dimensional, locally connected continua and two-dimensional manifolds. Author (TAB)

N70-11489# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
CONTROL OF A CLASS OF DISTRIBUTED SYSTEMS WITH NOISY MEASUREMENTS
Paul C. Badavas and George N. Saridis Jul. 1969 135 p refs
(Contract N00014-67-A-0226)
(AD-693518; TR-EE69-9) Avail: CFSTI CSCL 12/1

The report presents an approach to the on-line control of a class of distributed systems, which can be modeled mathematically by the general second order elliptic equation with unknown coefficients. The domain of definition of the system is finite. The distributed and/or boundary control functions are approximated by a finite set of linearly independent and bounded functions and an unknown set of constant parameters. The control parameters are estimated using stochastic approximation and random optimization algorithms, and minimizing a mean-square error criterion, with noisy measurements of the response being available at a finite number of points in the domain of definition of the system. Sampling theory is used to determine the minimum number of measurement points. The feasibility of the approach is demonstrated by simple examples. Sensitivity analysis is used, by assuming partial knowledge of the form of the response for these examples, in order to increase the sensitivity of the search algorithms, and consequently, accelerate their convergence. An off-line control procedure is also presented for the same class of problems. It consists of identifying the response of the system, in

the finite domain, to a number of different distributed and/or boundary control functions. Author (TAB)

N70-11470# Air Force Cambridge Research Labs., Bedford, Mass.
REDUCTION OF THE DIRECT PRODUCT OF REPRESENTATIONS OF THE POINCARE GROUP
H. E. Moses Jul. 1969 44 p refs *Its* Phys. and Mathematical Sci. Res. Papers No. 385
(AD-692770, AFCRL-69-0295) Avail: CFSTI CSCL 12/1

The direct product of two representations of the Poincare group are expanded into representations of the Poincare group in the general case that the factors of the direct product may have any mass, whether real, zero, or imaginary, and the total energy may be indefinite. The representations of the Poincare group, which appear in the expansion of the direct product have masses which run through a continuous spectrum of real and imaginary values and are irreducible in terms of the mass and sign of energy (for real mass), but are reducible in terms of the infinitesimal generators of the little groups. To obtain the expansion in terms of irreducible representations, one need only reduce the infinitesimal generators of the little groups. This reduction is carried out for the real mass components and, in principal at least, can be carried out for the infinitesimal generators for the imaginary mass components. The factors of the direct product and the representations which appear in the expansion are expressed in terms of a particular momentum representation called the standard helicity representation which enables one to use a uniform notation for all masses, whether real, zero, or imaginary. The earlier portions of the present paper summarizes the properties of these representations. Author (TAB)

N70-11492# Mitre Corp., Bedford, Mass. Electronic Systems Div., Bedford, Mass.
NONLINEAR PREDICTION AND DIGITAL SIMULATION
J. F. A. Ormbsby Jun. 1969 33 p refs Prepared for Electronic Systems Div.
(Contract AF-19(628)-2390)
(AD-693549; ESD-TR-69-184; W-7550) Avail: CFSTI CSCL 12/1

An approach to digital nonlinear prediction is proposed and analyzed. The basic relations are developed. The nonlinear operator is obtained by quantization of the data. The model is developed in terms of occupancy of data cells in N-space. Extensions to increase occupancy and reduce error are formulated. Illustrative results are included. A comparison with linear techniques is made and over-all conclusions on error, quantization level, length of data required, time invariance, etc., are provided. Author (TAB)

N70-11498# Ballistic Research Labs., Aberdeen Proving Ground, Md. Applied Mathematics Div.
A BIBLIOGRAPHY FOR THE NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS
John H. Giese Jul. 1969 216 p refs
(AD-692827; BRL-MR-1991) Avail: CFSTI CSCL 12/1

A list of 2561 references to the numerical solution of partial differential equations has been compiled. References to reviews in several abstracting journals have been given, and a crude index has been prepared. Author (TAB)

N70-11531# Texas A and M Univ., College Station. Inst. of Statistics.
STATISTICAL CONTROL FOR NON-LINEAR OPTIMIZATION
H. O. Hartley and R. C. Pfaffenberger Sep. 1969 28 p refs
(Contract N00014-68-A-0140)
(AD-693507; TR-18) Avail: CFSTI CSCL 12/2

The paper delineates an algorithm which provides a statistical point estimate as well as a statistical upper confidence point for the global optimum, say g^*, in a non-convex mathematical programming problem. Further, the procedure will supply a value of the input vector, x dot, so that g(x dot), the objective function evaluated at x dot, is close to g^*. Two examples involving the optimization of second order response surface designs with known global optima are given for the purpose of comparing the point estimate and the upper confidence point estimate with the known values. Author (TAB)

N70-11532# California Univ., Berkeley. Operations Research Center.
A BRANCH AND BOUND METHOD FOR OPTIMAL FAULT FINDING
Richard W. Butterworth Aug. 1969 72 p refs
(Contracts DA-31-124-ARO-D-331; NSF GK-1684)
(AD-693640; ORC-69-21) Avail: CFSTI CSCL 12/2

The problem is that of optimally testing a coherent system to learn some characteristic of it, for example, whether it is operating or not. A branch and bound and a dynamic programming solution are given, as well as a comparison of computer computation times for both. Several specific models with analytical solutions are also presented. Author (TAB)

N70-11580# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATING A SYSTEM WITH COMBINED ACTIVE AND PASSIVE ADAPTATION
Iliya Tomov et al 10 Jul. 1969 8 p refs Transl. into ENGLISH from Izv. Bulgar. Akad. Nauk., Inst. Tekhn. Kibernetika (Bulgaria), v. 6, 1967 p 73-84
(AD-693596; FTD-HT-23-1017-68) Avail: CFSTI CSCL 12/1

A system of combined (active and passive) adaptation is examined. Active adaptation is based on the principle of an auxiliary operator, the passive system of conditional feed-back. The possibility of an active adjustment of a systems individual elements which are characterized by passive adaptation is investigated and relationships governing the structure of auxiliary operators are derived. An experimental study is made, using an analog computer, of the combined adaptation and active adjustment of object parameters. The effect of the input signal and the number of parameters adjusted on the precision of the adjustment is noted. Author (TAB)

N70-11584# RAND Corp., Santa Monica, Calif.
SYSTEMS ANALYSIS FOR DEVELOPMENT DECISIONS APPLICABILITY, FEASIBILITY, EFFECTIVENESS AND EFFICIENCY
Yehezkel Dror Aug. 1969 28 p refs Prepared in cooperation with Hebrew Univ.
(AD-693001; P-4159) Avail: CFSTI CSCL 5/4

Systems analysis is more and more regarded as an important aid for improving crucial development decisions. Aid-giving organizations located in modern countries especially seem to be eager both to use systems analysis in making program decisions and to help development countries to use systems analysis for their own decision processes. Evaluation of the potential uses of systems analysis for development decisions involves examination of four distinct issues: criteria for applicability to development decisions of systems analysis in its present and near-future-state-of-the-art; requisites of feasibility of systems analysis; requirements of effectiveness; and conditions of efficiency. TAB

N70-11596# Hebrew Univ., Jerusalem (Israel). Applied Logic Branch.
MODEL THEORY FOR TENSE LOGICS
Dov M. Gabbay Apr. 1969 70 p refs
(Contract F61052-68-C-0036)

(AD-693632; AFOSR-69-2334TR; SR-1) Avail: CFSTI CSCL 12/1

The paper gives a complete semantics for a wide class of tense predicate logics. Ultraproducts of tense structures are further defined and are applied to prove compactness and the Craig interpolation theorem. TAB

N70-11605# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.

SOLUTION PROCEDURES FOR MULTI-STAGE LINEAR PROGRAMMING UNDER UNCERTAINTY AND APPLICATIONS

Rajagopalan Jagannathan 19 May 1969 121 p refs

(Contract Nonr-760(24))

(AD-693159; RR-158) Avail: CFSTI CSCL 12/2

In considering linear programming with stochastic parameters it is necessary to distinguish two types of models; first, the static model, for which only one decision has to be made and second, the dynamic models which involve sequential decision-making. A majority of the LP formulations that occur in applications are, at least in principle, sequential in nature and involve parameters that are known with certainty. One of the primary objectives of the dissertation is to define a class of what we call Dynamic Linear Programming Under Uncertainty models and to provide a theoretical framework for developing algorithms for solving such problems. Author (TAB)

N70-11648# Joint Publications Research Service, Washington, D.C.

CYBERNETICS, REGULATION THEORY AND MATHEMATICS

14 Oct. 1969 11 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 187, no. 5, 1969 p 1002 - 1004 and 1009 - 1011

(JPRS-49052) Avail: CFSTI

CONTENTS:

1. DYNAMIC MULTILEVEL GAMES Yu. A. Flerov p 1 - 4 refs (See N70-11649 02-19)

2. THE PROBLEM OF OPTIMIZING COMPLEX-MULTIPLY CONNECTED LARGE SYSTEMS M. V. Meyerov et al p 5 - 9 refs (See N70-11650 02-19)

N70-11649# Joint Publications Research Service, Washington, D.C.

DYNAMIC MULTILEVEL GAMES

Yu. A. Flerov *In its* Cybernetics, Regulation Theory and Math. 14 Oct. 1969 p 1 - 4 refs (See N70-11648 02-19)

Avail: CFSTI

Dynamic multilevel games (DMG) are discussed in terms of the general concept they provide for formalizing the autonomous nature of subsystems and the hierarchial structure of the entire system. Four theorems are given: (1) In a DMG, each mixed strategy has a behavior strategy equivalent to it. (2) In simultaneous and cyclic DMG, each mixed strategy has a stationary behavior strategy equivalent to it. (3) Cyclic and simultaneous DMG, for which the states of the games of each position are finite games or infinite games with a compact space of strategies of each player and a continuous payoff function, have an equilibrium point in the class of stationary behavior strategies of the players. (4) In a sequential DMG, there is an equilibrium point in the class of stationary behavior strategies of the players. Proofs for each are briefly discussed. Author

N70-11650# Joint Publications Research Service, Washington, D.C.

THE PROBLEM OF OPTIMIZING COMPLEX-MULTIPLY CONNECTED LARGE SYSTEMS

M. V. Meyerov et al *In its* Cybernetics, Regulation Theory and Math. 14 Oct. 1969 p 5 - 9 refs (See N70-11648 02-19)

Avail: CFSTI

An approach to solving large dimension problems of mathematical programming, arising when optimizing complex multiply connected systems, is presented. This technique makes it possible to obtain a solution in an acceptable number of iterations on a digital computer with a small operative memory or on a PERT model. Author

N70-11653# Army Foreign Science and Technology Center, Washington, D.C.

EXTREMAL PROBLEMS ON THE GEOMETRIC THEORY OF FUNCTIONS [EKSTREMALNYE ZADACHI GEOMETRICHESKOI TEORII FUNKTSII]

E. G. Golunzina et al [1969] 160 p refs Transl. into ENGLISH from Tr. Mat. Inst., Akad. Nauk SSR (Moscow), v. 94, 1968 p 1 - 145

(AD-692805; FSTC-HT-23-403-68) Avail: CFSTI CSCL 12/1

A collection of ten papers from the V. A. Steklov Institute of Mathematics, Academy of Sciences, USSR, is presented which treats various problems in the geometric theory of functions of a complex variable. Attention is given to the theory of kernels of a multiply-connected domain to investigated extremal properties of conformal schlicht mappings of a multiply-connected onto mutually non-overlapping domains. The problem of mutual growth of the coefficients of one close of p-sheeted functions is discussed in a paper by Ye. G. Goluzina, while the problems of the minimum transfinite diameter of a continum containing three fixed points, and new variation formulas for Stieltjes integrals has been extended by G. V. Kuzmina and Lebedev-Aleksandrov respectively. Theorems and proofs are presented through-out. Author (TAB)

N70-11665# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

CLASSES OF COMPUTABLE FUNCTIONS DEFINED BY BOUNDS ON COMPUTATION

Edward M. Mc Creight Jul. 1969 110 p refs

(Contract F44620-67-C-0058)

(AD-693327; AFOSR-69-2195TR) Avail: CFSTI CSCL 12/1

The structure of the sets of functions computable in time or space (or some other computational resource) bounded above by t is investigated for recursive functions t. The paper contains three principle results. First, if t0,t1,... is a recursively enumarable increasing sequence of recursive functions, then there is a recursive function t* such that the functions computable in resource bound t* are exactly those computable in resource bound ti for some i. Second, any countable partial order can be isomorphically embedded in the family of t-computable classes of functions, partially ordered by set inclusion. Finally, for any recursive t there is a recursive t which is (almost) the running time of a program, such that exactly those functions computable in resource bounded by t are computable in resource bounded by t. Author (TAB)

N70-11669# Parke Mathematical Labs., Inc., Carlisle, Mass.

A NEW METHOD FOR ACOUSTICAL RADIATION PROBLEMS WITH MIXED BOUNDARY VALUES

John L. Butler Sep. 1969 35 p refs

(Contract N00014-67-C-0424)

(AD-693319; SR-4; Rept-0424) Avail: CFSTI CSCL 20/1

A series expansion method for the solution of acoustical radiation problems with mixed boundary values is presented. In this method a wavefunction expansion is truncated to include only the number of terms equal to the number of specified boundary values. The solution improves as this number increases, and coeffients may be evaluated through a matrix inversion. The particular case of a radiator on a sphere is treated and results are presented which

show that the sound beam is more directive if the remaining portion of the sphere is soft. Author (TAB)

N70-11693# Watervliet Arsenal, N.Y. Benet R and E Labs.
TABLES FACILITATING CONFIDENCED RELIABILITY CALCULATIONS FOR THE NORMAL OR LOGNORMAL DISTRIBUTION
Royce W. Soames, Jr. Aug. 1969 29 p refs
(AD-693265; WVT-6937) Avail: CFSTI CSCL 14/4

Small sample size tables are presented which facilitate reliability--mission life calculations at a given confidence level. The tables are calculated using the exact sampling distribution of the normal reliability estimator. A computer program is included which will enable one to calculate more extensive tables for different sample sizes and confidence levels. Author (TAB)

N70-11749# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONVERGENCE CONDITIONS AND ESTIMATION OF ERROR IN AN APPROXIMATE INVERSION OF A LAPLACE TRANSFORM WITH THE AID OF A FOURIER SERIES
V. I. Krylov et al 30 Jun. 1969 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR (Minsk), v. 11, no. 9, 1967 p 763–766
(AD-693525, FTD-HT-23-328-68) Avail: CFSTI CSCL 12/1

It is pointed out that the solution of many problems in mechanics and engineering by means of the Laplace transformation is reduced to the problem of determining the inverse function f(t) from its known Laplace transform F(p). For determining f(t), expanded in Fourier series in sines and in cosines, the values of F(p) in the integer points are used. The problem of the convergence of these series and an estimate of the remainder for certain classes of functions are analyzed. As in the majority of applied problems the properties of f(t) are unknown, and only the Laplace transform F(p) is known, the authors try to formulate the convergence conditions and to determine the remainder in terms of F(P). Two theorems are proved establishing conditions which must be imposed upon F(p) so that the above-mentioned Fourier expansions of f(t) in sines and cosines uniformly converge. The asymptotic expressions are derived for their remainders. Author (TAB)

N70-11803# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE METHOD OF STRUCTURING ITERATION PROCESSES
A. N. Konovalov 3 Jul. 1969 8 p refs Transl. into ENGLISH from Sibirskoye Otd. Izv. Ser. Tekhn. Nauk (Russian), no. 3, 1967 p 105–109
(AD-693485; FTD-HT-23-147-69) Avail: CFSTI CSCL 12/1

A solution for the differential problem is calculated as one means of structuring the iterational process. The author states that in the use of this method sets of inequality relationships are developed, which relate the accuracy of the process with a number of iterations; also a solution was developed for the difference analog of the planar static problem of the theory of elasticity. Author (TAB)

N70-11806*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
NEW NECESSARY CONDITIONS OF OPTIMALITY FOR CONTROL PROBLEMS WITH STATE-VARIABLE INEQUALITY CONSTRAINTS
D. H. Jacobson, M. M. Lele, and J. L. Speyer Aug. 1969 41 p refs
(Grant NGR-22-007-068; Contract N00014-67-A-0298-0006; Proj. NR-372-012)
(NASA-CR-106910; TR-597) Avail: CFSTI CSCL 12A

Necessary conditions of optimality for state-variable inequality constrained problems are derived by examining the limiting behavior of the Kelley penalty function technique. The conditions so obtained differ from those presently known, with regard to the behavior of the adjoint variables at junctions of interior and boundary arcs. A second, rigorous, derivation is given; this confirms the necessary conditions obtained by the limiting argument. These conditions are related to those known earlier; in particular, it is shown that the earlier conditions over-specify the behavior of the adjoint variables at the juntions. An example is used to demonstrate that the earlier conditions may yield non-stationary trajectories. For the regular case, it is shown that, under certain conditions, only boundary points, as opposed to boundary arcs, are possible. An analytic example illustrates this behavior. Author

N70-11809*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
MATHEMATICAL PROGRAMMING METHODS OF PATTERN CLASSIFICATION
Richard C. Grinold Jun. 1969 25 p refs
(Grant NGR-22-007-143; Contract N00014-67-A-0298-0006; Proj. NR-372-012)
(NASA-CR-106903; TR-591) Avail: CFSTI CSCL 12A

This paper studies four mathematical programming methods which are useful in pattern classification. Two of the models are for linearly separable problems, while the others work without separability. Author

N70-11848# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE DIFFERENTIAL GAME WITH TIME CHOICE
I. P. Yachyauskas 11 Jul. 1969 8 p refs Transl. into ENGLISH from Lietuvos Matematikos Rinkinys (USSR), v. 9, no. 27, 1967 p 357–362
(AD-693503; FTD-HT-23-249-69) Avail: CFSTI CSCL 12/2

A pursuer P and an evader E move in the plane, with constant speeds v, u, respectively but are free to change their direction at any time. P is allowed to fire once, at a moment of his choice, the probability p of hitting E depending on the distance between them. The author reduces the game to one with terminal payoff. The nomenclature and methods are those of R. Isaacs. The author derives the optimal trajectories and the value of the game both for the case in which the end of the game takes place at an ordinary point (of the boundary of the 4-dimensional region in which P should fire at t equal 0) and the case of a singular point. Author (TAB)

N70-11849# Hebrew Univ., Jerusalem (Israel). Applied Logic Branch.
MODEL THEORY FOR INTUITIONISTIC LOGIC, PART 1
Dov M. Gabbay May 1969 22 p refs
(Contract F61052-68-C-0036)
(AD-693636; Scientific-2; AFOSR-69-2335-TR) Avail: CFSTI CSCL 12/1

Ultraproducts for Kripke predicate calculus are defined, and the usual properties are proved up to the application of the proof of the compactness theorem. It is also proved that, given any two elementarily equivalent structures, one is embeddable in an ultrapower of the other. The general form of Robinsons consistency theorem is refuted. Author (TAB)

N70-11852*# Arizona Univ., Tucson. Engineering Experiment Station.
MONTE CARLO SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS USING A HYBRID COMPUTER
Howard Handler *In its* Analog, Hybrid, and Digital Simulation 1968 8 p refs (See N70-11851 02-08)
Avail: CFSTI CSCL 12A

The analog-hybrid computer Monte Carlo technique for solving elliptic and parabolic partial differential equations has been

implemented on a new hybrid computer capable of taking statistics over 1000 two- or three-dimensional random walks per second. This exceptional computing speed and flexible digital control permit direct plotting of partial differential equation solutions; of perhaps even greater interest is the incorporation of such Monte Carlo routines in real-time analog computer setups in process control applications. In this connection, the Monte Carlo method has been extended to a wider class of problems, and is especially applicable to heat conduction/diffusion problems. Author

N70-11853*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
CORRELATION METHOD FOR COMPUTING SENSITIVITY FUNCTIONS ON A HIGH-SPEED ITERATIVE ANALOG COMPUTER
Emmet P. O'Grady *In its* Analog, Hybrid, and Digital Simulation 1968 7 p refs (See N70-11851 02-08)
(Grant NSG-646)
Avail: CFSTI CSCL 12A

During successive high-speed iterative-analog-computer runs, the parameters a1, a2, ..., a(m) of a simulated dynamical system are perturbed by mutually orthogonal binary sequences of perturbations. Each parameter perturbation remains constant during a full 1-ms analog-computer run. Simple correlation of the perturbed solution-sample sequences with each parameter-perturbation sequence simultaneously produces approximations to all the system sensitivity coefficients as the sampling time is automatically stepped. Note that correlation with binary variables requires no multipliers. The new technique is compared to the conventional method requiring separate sensitivity-equation setups for each sensitivity coefficient, and a simple example is presented. Author

N70-11854*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
STATE-SPACE METHODS FOR DESIGNING DIGITAL SIMULATIONS OF CONTINUOUS FIXED LINEAR SYSTEMS
J. V. Wait *In its* Analog, Hybrid, and Digital Simulation 1968 4 p refs (See N70-11851 02-08)
Avail: CFSTI CSCL 12A

Four somewhat different methods are presented. Method I is an interpolative method, suitable for many all-digital simulations. Method II is an extrapolative method, suitable for hybrid analog-digital simulations and cases involving closed-loop systems with nonlinearities. Method I calculates values of the output vector y and state vector q at t = nT, using values of the input vector, x, at times t = nT and (n − 1)T. Method II is quite similar, except that the calculations use values of the input at t = (n − 1)T and (n − 2)T, so that these samples may be received from an external signal source and used to calculate output samples at t = nT. Both methods use straight-line approximations for the input signals between sample instants. Method I uses closed linear interpolation analogous to a nonrealizable first-order hold. Method II uses open linear extrapolation analogous to a realizable first-order hold. Methods III and IV are preferable for simulating systems with step inputs. Author

N70-11855*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
EXPERIMENTS WITH DIGITAL COMPUTER SIMULATIONS OF PSEUDO-RANDOM NOISE GENERATORS
R. C. White, Jr. *In its* Analog, Hybrid, and Digital Simulation 1968 3 p refs (See N70-11851 02-08)
(Grant NSG-646)
Avail: CFSTI CSCL 12A

This note describes experiments performed with digital computer simulations of shift-register pseudo-random noise generators. It has been suggested that summation over a set of adjacent bits yields pseudo-binomially distributed sums; sums over nonoverlapping bits are also uncorrelated. Experimental frequency distributions of the generator outputs were found for three different noise generators, and these distributions were compared to the probability distributions which would result from true-random-noise generators. Results indicated that shift-register generated pseudo-random noise should not be used for simulating linear dynamic systems when direct output distribution measurements are desired. In the case of nonlinear systems, even mean squares and input – output correlation functions might be erroneous unless the noise permits linearization methods. G.G.

N70-11857*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
HYBRID ANALOG-DIGITAL SAMPLE-AVERAGING COMPUTER FOR ASTRAC II
R. L. Maybach *In its* Analog, Hybrid, and Digital Simulation 1968 7 p refs (See N70-11851 02-08)
Avail: CFSTI CSCL 12A

This report describes the circuit design of a new hybrid analog-digital statistical averaging computer used to calculate statistical averages of analog voltages presented to it. The unit, with a dynamic range of plus or minus 10 volts, an accuracy of plus or minus 0.25 percent, and a maximum speed of 1000 samples per second, is particularly well suited for use with modern high-speed iterative analog computers. The output is primarily visual, but electrical signals are also available for use by digital computers, printers, punches, and the like. Circuit simplifications have resulted in an inexpensive unit which requires few adjustments. Digital storage of sums eliminates the drift present in pure analog averaging schemes if the summation time is long. Author

N70-11924# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ALL-UNION SYMPOSIUM ON APPLIED MATHEMATICS AND CYBERNETICS
A. F. Lapko 1 Jul. 1969 4 p ref Transl. into ENGLISH from Usp. Mat. Nauk (USSR), v. 22, no. 5 (137), 1967 p 215
(AD-693527; FTD-HT-23-353-68) Avail: CFSTI CSCL 12/1

An All-Union symposium on applied mathematics and cybernetics, organized by the Scientific Research Institute of Applied Mathematics and Cybernetics of Gorki University was held in Gorki from 29 May to 3 June 1967. Papers and reports (495) were presented in the following sections: (1) qualitative theory of differential equations (44 papers); (2) dynamic systems (102 papers); (3) problems of stability and of transient processes in control systems (34 papers); (4) extremal problems and systems (92 papers); (5) pattern recognition and diagnostics (53 papers); (6) mathematical logic and its applications (25 papers); (7) applied methods for solving optimization and automatic control problems (69 papers); (8) biocybernetics (58 papers); and (9) applied linguistics (18 papers). TAB

N70-11937*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
NONZERO-SUM DIFFERENTIAL GAMES: CONCEPTS AND MODELS
Alan W. Starr Jun. 1969 155 p refs
(Grant NGR-22-007-068; Contract N00014-67-A-0298-0006; Proj. NR-372-012)
(NASA-CR-106914; TR-590) Avail: CFSTI CSCL 12A

A general class of differential games, where the N players try to minimize different cost criteria by controlling inputs to a single dynamic system, is investigated as an extension of optimal control theory. Dropping the usual zero-sum assumption makes it possible to model a more realistic class of competitive situations where mutual interest is important. The nonzero-sum formulation has several interesting analytic and conceptual features not found in zero-sum differential games. It is no longer obvious what should be demanded of a solution, and three types of solution concepts

are discussed: Nash equilibrium, minimax, and noninferior (or Pareto optimal) strategies. For one special case, the linear-quadratic differential game, all of these solutions can be computed exactly by solving sets of coupled ordinary matrix differential equations. Another feature not found in optimal control problems or in two-person, zero-sum differential games is the difference between open loop and closed loop equilibria. Author

N70-11983# Council for Scientific and Industrial Research, Pretoria (South Africa). Statistics Div.

PROBABILITY INTEGRALS AND CRITICAL VALUES OF A BIVARIATE STUDENT t-DISTRIBUTION

F. E. Steffens 1968 79 p refs

(WISK-44) Avail: CFSTI

Let t sub 1 and t sub 2 be two independent normally distributed random variables with zero means and equal variances, each divided by a common estimate of the standard deviations. The joint distribution of t sub 1, t sub 2 is a bivariate Student t-distribution. The integral of the joint frequency function over certain types of critical regions in the (t sub 1, t sub 2)-plane may be written as the linear combination of two definite integrals. These integrals are tabulated for various degrees of freedom. Tables of critical values for various alternative hypotheses in simultaneous tests on t sub 1 and t sub 2 are also included. Author

N70-11984# State Univ. of New York at Buffalo. Dept. of Mathematics and Computer Science.

INTEGRATION FORMULAS AND ORTHOGONAL POLYNOMIALS PART 2

A. H. Stroud Oct. 1969 16 p refs

(Grants NSF GP-8954; NSF GP-13287)

(Publ-4) Avail: CFSTI

A necessary and sufficient condition that the common zeros of a set of polynomials in n variables can be used as the points in an integration formula for an n-dimensional region is given. This result applies for all n greater than or = to 1. Author

N70-11986# State Univ. of New York at Buffalo. Dept. of Computer Science.

REMARKS ON SOLUTION OF THE DIRICHLET PROBLEM BY GAUSS QUADRATURE FORMULAS

A. H. Stroud and Ping-Lei Wang Oct. 1969 28 p refs

(Grants NSF GP-8954; NSF GP-13287)

(Publ-5) Avail: CFSTI

The possibility is discussed of approximating the solution of an equation where the second partial derivatives of U with respect to x and y equals zero at a specific point in a region R when U(x, p) is given on the boundary B of R by numerical integration of a line integral around B. Integration formulas for this problem can be found in some cases with N points and which are exact to the 2N − 1 linearly independent harmonic polynomials of degree less than or equal to N − 1. The proof of existence or nonexistence of such formulas is not yet known in general. Tables of some formulas are given for the circle and square. Author

N70-11972# State Univ. of New York at Buffalo.

ON THE DIAGONALIZATION OF COMPLEX SYMMETRIC MATRICES

P. J. Eberlein [1969] 8 p refs

(Grants NSF GP-8954; NSF GP-13287) Avail: Issuing Activity

A norm-reducing Jacobi algorithm is described for the diagonalization of a complex symmetric matrix. This algorithm is in some ways a special case of a previously described algorithm. When programmed as a special case, however, this algorithm uses about one-half the store as the general problem and less than one-half the number of multiplications. The program itself is much simpler. The choice of an optimal parameter is also treated in more detail. To minimize the sum of squares of absolute values of the off-diagonal elements of the matrix iterates, as in the Jacobi method for real symmetric matrices, it is proposed that minimization of the sum of squares of absolute values of all matrix elements be considered. Author

N70-11985# Akademiya Nauk URSR, Kiev. Inst. for Theoretical Physics.

APPLICATION OF SOME THEOREMS FROM THE THEORY OF ANALYTIC FUNCTIONS AND CONFORMAL MAPPING TO THE SCATTERING AMPLITUDE AND FORMFACTORS

V. Z. Baluny 1969 55 p refs In RUSSIAN; ENGLISH summary Presented at the Seminar in Inst. for Theoret. Phys., Kiev, 1969

(ITF-69-15) Avail: AEC Depository Libraries

On the basis of the Nevanlinne principle, a number of bounds on the scattering amplitude and form factors were previously established. The present aim is to give a systematic and detailed survey of these results, though it contains some original results. An introduction is given to the mathematical technique of the theory of harmonic measure and conformal mapping. On the basis of axiomatic analyticity, the lower bound for the scattering amplitude at fixed momentum transfer is established and a new method is given for the estimation of the upper bound of the width of the diffraction peak. The upper bound of the radii of elementary particles and the lower and upper bounds of form factors in the space-like region is derived. Author (TAB)

N70-11987# Stanford Linear Accelerator Center, Calif.

BI-DIRECTIONAL AND HEURISTIC SEARCH IN PATH PROBLEMS

Ira Pohl May 1969 157 p refs

(Contract AT(04-3)-515)

(SLAC-104) Avail: CFSTI

The shortest path problem is defined. Developments of algorithms for handling this type of problem are discussed; types of bi-directional methods, using a cardinality comparison strategy, and stopping conditions are considered. A description of the very general algorithm (VGA) is formulated; correctness proofs are given. A probabilistic analysis of the optimality of the cardinality comparison is detailed. Results of a computer program for VGA, written in ALGOL, are given; data are tabulated. A formal model for a heuristic searce is developed; a heuristic path algorithm is constructed. Uni-directional and bi-directional heuristic search problems and theories are discussed; error effects and correctness are analysed. The ALGOL writeup for the VGA is presented; results of different search strategies in VGA are compared. The ALGOL program for the heuristic VGA solution to the fifteen puzzles is included. NSA

N70-12001# Akademia Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

TOWARDS A UNITARY PHENOMENOLOGICAL AMPLITUDE OF STRONG INTERACTION

L. L. Enkovski, V. V. Kukhtin, V. A. Miranskii, and V. P. Shelest 1969 6 p refs

(ITF-69-37) Avail: AEC Depository Libraries

The possibility of unitarization of the Veneziano model is investigated. While a proof of the unitarity of the Veneziano amplitude is not given, nevertheless, the estimates show that by an appropriate choice of alpha (s), an analytic function with a right-hand cut satisfying a dispersion relation with subtractions, and of the parameters, the Veneziano formula does not contradict unitarity. NSA

N70-12017# State Univ. of New York at Buffalo. Dept. of Mathematics.

SOLUTION TO THE COMPLEX EIGENPROBLEM BY A NORM REDUCING JACOBI TYPE METHOD

P. J. Eberlein 21 Aug. 1969 23 p refs
(Grant NSF 50-1206-A)
(MOS-6540) Avail: CFSTI

Let C = (c sub ij) = A + iZ be a complex n x n matrix having real part A = (a sub ij) and imaginary part Z = (z sub ij). A complex matrix W = T + iU = W sub 1 W sub 2...W sub k is constructed as a product of nonsingular two-dimensional transformations W sub j such that the off-diagonal elements of W to the minus 1 power C W = C(difference) are arbitrarily small. The diagonal elements of C(difference) are now approximations to the eigenvalues and the columns of W are approximations to the corresponding right eigenvectors. In the complex case given the parameters alpha and x are chosen so that if the matrix is either Hermitian or skew-Hermitian the usual Jacobi parameters are obtained. The derived algorithm may be used to solve the eigenproblem for any complex n x n matrix. If the matrix is normal, other methods are clearly faster; however, if the matrix is Hermitian or skew-Hermitian, the algorithm reduces to the usual Jacobi method. Left vectors, or both right and left vectors may be obtained by making the obvious changes to the program. R.B.

N70-12036# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
ANALYTICAL CONTINUATION OF THE EXPANSION IN ORTHOGONAL POLYNOMIALS AND THE PROPERTIES OF THE SCATTERING AMPLITUDE
V. A. Yatsun 1969 25 p refs In RUSSIAN
(ITF-69-29) Avail: CFSTI

The analytical properties of the expansions in orthogonal polynomials on the basis of their connection with the properties of the corresponding Taylor series with the same coefficients are studied. The results are applied in the investigation of the amplitude structure in the plane of the scattering angle cosine.
Author (NSA)

N70-12047# Syracuse Univ., N.Y. Dept. of Physics.
AN INFINITE SET OF MODELS SATISFYING CROSSING SYMMETRY, DUALITY, AND REGGE BEHAVIOR
C. W. Gardiner May 1969 6 p refs Sponsored by AEC
(NYO-3399-196; SU-1206-196) Avail: CFSTI

A set of models, characterized by two functions, h(X), omega(X) is given which satisfies the conditions of duality, crossing symmetry and Regge behavior. These models can be written, and are generalizations of the beta function. The model still considers only resonances of zero width. Author (NSA)

N70-12059# Bonn Univ. (West Germany).
NON-NUMERICAL MATHEMATICS AND DATA PROCESSING
F. Krueckeberg *In* AGARD Storage and Retrieval of Inform.: A User-Supplier Dialogue Jun. 1968 p 89–98 refs (See N70-12051 02-08)
Avail: CFSTI

Several problems involving nonnumerical mathematics are listed. In the field of nonnumerical data processing, the following topics are discussed briefly: group theory, games theory, translation, graph theory, and pattern recognition and enhancement. Author

N70-12087# United Kingdom Atomic Energy Authority, Harwell (England)
RANK ONE METHODS FOR UNCONSTRAINED OPTIMIZATION
M. J. D. Powell Jun. 1969 28 p refs
(TP-372) Avail: CFSTI

Many methods for unconstrained optimization depend on an estimate of the second derivative matrix of the objective function. The rank one methods obtain an estimate from first derivatives, in an economic and elegant way, that does not require any searches along lines in the space of the variables of the objective function. A new rank one algorithm is defined.
Author (NSA)

N70-12112# Syracuse Univ., N.Y. Dept. of Physics.
QUANTUM THEORY OF THE GENERALIZED WAVE EQUATIONS, PART 1
Kishor C. Tripathy May 1969 39 p refs Sponsored by AEC
(NYO-3399-197; SU-1206-197) Avail: CFSTI

A systematic analysis of the quantum theory of the infinite component fields that transform under the combined representations of the direct product of SL(2,C) (Majorana) and Dirac was made. A complete set of solutions of the wave equation includes solutions with time-like and space-like momentum. The mass spectra for the time-like and space-like cases were explicitly calculated. The method makes use of the decomposition of the product representation into reducible representations of the little groups SU(2) and SU(1,1). Finally, the quantization of the generalized fields is presented.
Author (NSA)

N70-12121# Syracuse Univ., N.Y. Dept. of Physics.
EXPANSION OF FUNCTIONS IN BINOMIAL POLYNOMIALS
C. W. Gardiner May 1969 10 p refs Sponsored by AEC
(NYO-3399-195; SU-1206-195) Avail: CFSTI

Proof is given for an expansion and inversion theorem for binomial polynomials which are defined by generating functions. Reciprocity and orthogonality relations between the polynomials are shown to exist, and conditions are investigated for the convergence of the binomials. B.G.D.

N70-12136# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ON ONE FORM OF ESTIMATE OF THE SPEED OF CONVERGENCE TO THE NORMAL LAW
Iu. P. Studnev 15 Aug. 1969 10 p refs Transl. into ENGLISH from Ukr. Mat. Zh. SSSR (Moscow), v. 20, no. 2, 1968 p 281–285
(AD-693365; CLB-3-T-593) Avail: CFSTI CSCL 12/1

A sequence is given of independently and identically distributed random variables with mathematical expectation 0 and variance 1. The distribution function and the characteristic function of the random variables are defined. A distribution function belonging to the characteristic function is also given. With these conditions, proof is given for the existence of absolute constants of the random variables having finite moments to a certain order and coinciding with the corresponding moments of the normal law. An estimate is also investigated which contains information of the rate of convergence in the case of a function with moments of higher order than previously discussed. B.G.D.

N70-12139*# Massachusetts Inst. of Tech., Cambridge.
STRUCTURAL PROPERTIES OF THE EQUILIBRIUM SOLUTIONS OF RICCATI EQUATIONS
Roger W. Brockett [1969] 9 p refs Sponsored in part by AROD
(Grants NGR-22-009-124; NSF GK-2645)
(NASA-CR-107029) Avail: CFSTI

The behavior of certain solutions of a quadratic matrix equation is studied as a function of a real variable. A new a priori bound on the solutions results. Variational interpretation of the associated Riccati equation is utilized, as well as the use of transform techniques and an elementary version of Parseval's formula.
Author

N70-12145# California Univ., Berkeley. Electronics Research Lab.
PERIODIC RESPONSES OF NONLINEAR FEEDBACK SYSTEMS
A. R. Bergen and R. L. Franks 19 Dec. 1968 42 p refs
(Grant AF-AFOSR-1488-68)

(AD-693209; ERL-M258) Avail: CFSTI CSCL 12/1

For the scalar feedback system shown in the document, an easily applied sufficient condition is derived which, for a periodic input, guarantees the existence of a periodic output of the same period. Error bounds for an approximate solution for the output are derived. TAB

N70-12148# West Indies Univ., Kingston (Jamaica). Computing Center.

THE APPLICATION OF DIGITAL COMPUTER TECHNIQUES TO THE STUDY OF GRAPH-THEORETICAL AND RELATED COMBINATORIAL PROBLEMS Final Report

Ronald C. Read, Clarence King, Charles C. Cadogan, and Philbert Morris 26 Aug. 1969 62 p refs

(Grant AF-AFOSR-1026-66)

(AD-693241; UWI/CC12; AFOSR-69-2199-TR) Avail: CFSTI CSCL 12/1

Research topics covered include the following: The construction of a programming language, and a corresponding compiler, especially designed for the easy programming of graph-theoretical problems; Preparation of catalogues of certain kinds of graphs with their properties; Enumeration of different kinds of graphs; The development of efficient algorithms for various properties of graphs e.g. planarity, existence of cut-nodes etc.; and Applications to related combinatorial problems. TAB

N70-12149# Columbia Univ., New York. Operations Research Group.

NETWORK FLOWS OVER EDGE-DISJOINT PATHS

Hiroshi Takamori 30 Dec. 1968 197 p refs

(Contract N00014-67-A-0108)

(AD-693139; TR-37) Avail: CFSTI CSCL 12/2

An algorithm for the following parallel bottleneck assignment problem is developed: Each of two production lines consists of m different jobs arranged in a serial order. Each job requires one man and any man can be occupied in no more than one job with a processing rate. The rate of each line is determined by the minimum processing rate of the men along the line, the bottleneck. Find the assignment of men to jobs which maximizes the sum of the rates of the two lines. Two routes are said to be edge-disjoint if they share no edges. An algorithm is developed to find a pair of edge-disjoint routes the sum of whose capacities is maximized. Author (TAB)

N70-12150# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

UNBIASED NEARLY BEST LINEAR ESTIMATES OF THE SCALE AND LOCATION PARAMETERS OF THE EXTREME VALUE DISTRIBUTION BY THE USE OF ORDER STATISTICS

Kenneth E. Eickmann (M.S. Thesis) Dec. 1968 434 p refs

(AD-693661; GRE/MATH/68-5) Avail: CFSTI CSCL 12/1

Unbiased nearly best linear estimates of the scale and location parameters of the (first) extreme value distribution of largest values estimators were calculated and tabled for sample sizes from 15 to 40. The tables include coefficients of estimators for complete samples along with values for samples singly censored from above as well as coefficients for estimators of doubly censored samples. For each entry in the tables an efficiency of the estimator relative to the complete sample estimator is also tabulated. Author (TAB)

N70-12155# Rand Corp., Santa Monica, Calif.

AN APPRAISAL OF SOME SHORTEST-PATH ALGORITHMS

S. E. Dreyfus Sep. 1968 46 p refs

(Contract F44620-67-C-0045)

(AD-693567; RM-5433-1-PR) Avail: CFSTI CSCL 12/2

The Memorandum discusses five discrete shortest-path problems: (1) determining the shortest path between two specified nodes of a network; (2) determining the shortest paths between all pairs of nodes of a network; (3) determining the second, third, etc. shortest path; (4) determining of the fastest path through a network with travel times depending on the departure time; and (5) finding the shortest path between specified endpoints that passes through specified intermediate nodes. Existing good algorithms are identified while some others are modified to yield efficient procedures. Also certain misrepresentations and errors in the literature are demonstrated. Author (TAB)

N70-12214# Harvard Univ., Cambridge, Mass. Dept. of Statistics.

A DOUBLE SAMPLING SCHEME FOR ESTIMATING FROM MISCLASSIFIED BINOMIAL DATA

Aaron Tenebein Jun. 1969 38 p refs

(Contract N00014-67-A-0298)

(AD-690886; TR-26) Avail: CFSTI CSCL 12/1

Two measuring devices are available to classify units into one or two mutually exclusive categories. The first device is an expensive procedure which classifies units correctly; the second device is a cheaper procedure which tends to misclassify units. In order to estimate P, the proportion of units in the population which belong to one of the categories, a double sampling scheme is presented. At the first stage, a sample of N units is taken and the fallible classifications are obtained; at the second stage of subsample of N units is drawn from the main sample and the true classifications are obtained. The maximum likelihood estimate of P is derived along with its asymptotic variance. Optimum values of N and N which minimize the measurement costs for a fixed variance of estimation and which minimize the variance for fixed cost are derived. TAB

N70-12258*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

CELESTIAL COORDINATE TRANSFORMATIONS

Nadine A. Bicket and Gilmer A. Gary 29 Aug. 1969 125 p refs

(NASA-TM-X-53943) Avail: CFSTI CSCL 12A

Three FORTRAN programs required to give the coordinate transformations among the equatorial, ecliptic, and galactic systems are described. A brief review of spherical trigonometry is included. From the equations given for coordinate transformations and a development of the equatorial and ecliptic systems, a method for the general transformations was derived. These coordinate transformations were developed and programmed for use in the determination of the ecliptic (Zodiacal Light) with respect to the other systems for analysis of the S-073/T-027 AAP experiment data analysis. Author

N70-12281# Queens Univ., Kingston (Ontario). Dept. of Mathematics.

APPROXIMATION OF AN INTEGRAL CONNECTED WITH HARD-LIMITED SIGNALS AND NOISE

L. L. Campbell Jul. 1969 16 p refs Sponsored by DRB

(RR-69-3) Avail: CFSTI

Let the input to a limiter consist of a desired sinusoidal signal, Gaussian noise, and n interfering sinusoids. The output signal can be expressed as a rather complicated integral which is difficult to evaluate numerically. However, if n is large enough, the sum of the sinusoids is approximately a Gaussian process and the expression for the output simplifies greatly. In this paper a bound is developed for the error which is made when this approximation is used. The same bounding technique could be applied to similar integrals which occur in other applications. The bound is of the order n to the minus 1 power when the amplitudes of all theinterfering sinusoids are approximately equal. Author

N70-12292# Hamburg Univ. (West Germany). Mathematisch-Naturwissenschaftliche Fakultät.

RIEMANN SPACES WITH MULTIPLE TRANSITIVI

ISOMETRY GROUP [RIEMANNSCHE RAEUME MIT MEHRFACH TRANSITIVER ISOMETRIEGRUPPE]
Bernd Schmidt (Ph.D. Thesis) 1968 51 p refs In GERMAN
Sponsored by Fritz ter Meer Stift
Avail: CFSTI

In order to find solutions of the field equations in general relativity homogeneous Riemann spaces are constructed and the Lie groups are determined which can be isometry groups of homogeneous spaces. After specifying the necessary and sufficient conditions for a continuous Lie group to be a true realization of a Riemann space, a homogeneous space is constructed in several steps. It appears that for every linear fixed group there exists a homogeneous space. The Lie algebras of special spaces require the subgroups of the Lorentz group to be determined. From the structure of the Lie algebras geometric properties of the spaces can be deduced. ESRO

N70-12299# Bettis Atomic Power Lab., Pittsburgh, Pa.
BE-21: A FEW GROUP SLAB TRANSPORT PROGRAM IN FORTRAN 4
E. Schmidt Jun. 1969 20 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-781) Avail: CFSTI

BE21 is a program written in FORTRAN IV for the CDC 6600. The program solves the few-group, slab geometry transport equation in the discrete ordinates approximation. Either homogeneous or inhomogeneous problems are permitted. In the former case either fission or time constant eigenvalues are found for arbitrary spatial modes. An exact spatial differencing scheme is included reducing the overall error of approximation to that due to angular and energy differencing. The maximum number of ordinates is 60 which may be divided arbitrarily among the groups subject to the condition that the ordinates in each group be nonzero and symmetric. Author (NSA)

N70-12315*# Clarkson Coll. of Technology, Potsdam, N.Y. Div. of Research.
EFFECTS ON THE MOTION OF A BODY ATTRACTED BY A ROTATING SOURCE, PART 2 Progress Report
Herbert Knothe 15 Oct. 1969 4 p
(Grant NGR-33-007-034)
(NASA-CR-106988) Avail: CFSTI CSCL 12A

A different analytical approach from one used earlier in the study of the effect on the motion of a body attracted by a rotating sphere is reported. An equation of motion which includes a representation of any small perturbing force is given for the treatment of the perturbation of a circular orbit. Solutions, in the form of power series and the method of variation of constants, are so assumed that the determinant is one. M.H.E.

N70-12397# Atomic Energy Establishment, Winfrith (England). Control and Instrumentation Div.
NEWLIN: A DIGITAL COMPUTER PROGRAM FOR THE LINEARISATION OF SETS OF ALGEBRAIC AND FIRST ORDER DIFFERENTIAL EQUATIONS
A. Hopkinson May 1969 32 p refs
(AEEW-R-639) Avail: HMSO 4s 6d; BIS $0.90; CFSTI

The techniques normally used for linearization of equations are not amenable to general treatment by digital computation. A computer program is described for linearizing sets of equations by numerical evaluations of partial derivatives. The program is written so that the specification of the nonlinear equations is the same as for the digital plant dynamics simulation program, FIFI, and the linearized equations can be punched out in form suitable for input to the frequency response program FRP 2 and the poles and zeros program ZIP. Full instructions for the use of the program are given and a sample problem input and output are shown. Author (NSA)

N70-12398# North Carolina Univ., Chapel Hill. Dept. of Statistics.
ON CERTAIN RESULTS FOR STATIONARY POINT PROCESSES AND THEIR APPLICATION
Malcolm R. Leadbetter May 1969 24 p refs *Its* Inst. of Statistics Mimeo Ser. No. 641
(Contract N00014-67-A-0002)
(AD-693627) Avail: CFSTI CSCL 12/1

The purpose of this report is to describe some viewpoints and certain recent results of point process theory, and their application. Section 2 contains series expressions for the distribution of the times between events both when measurement is made from a fixed time, and from an arbitrary event of the process. Relations between these series are also discussed. (These results were obtained in collaboration with R. J. Serfling.) Section 3 concerns applications, particularly to zero-crossings problems. In Section 4, the method of defining a stationary point process by means of a stationary sequence of non negative random variables (due to Kaplan) is discussed and related to the previously described framework. Section 5 deals with the approximation of stationary point processes consisting of rare events by Poisson processes. Author (TAB)

N70-12414# California Univ., Livermore. Lawrence Radiation Lab.
AN ITERATIVE, TIME DOMAIN METHOD OF SYSTEM RESPONSE CORRECTION
Michael P. Ekstrom 23 Jun. 1969 10 p refs Presented at Western Electron. Show and Conv., San Francisco, 22 Aug. 1969
Sponsored by AEC
(UCRL-71796; Conf-690806-2) Avail: CFSTI

A method is described for optimum correction of the convolutional distortion associated with linear physical systems. In contrast to previous techniques of system compensation, the scheme presented is formulated entirely in the time domain. The correction is based on minimizing a time domain error criterion subject to physical realizability constraints. The compensator network realization is determined by an iterative, time domain synthesis procedure. The problem solution is suitable for numerical calculation, examples of which are presented. Author (NSA)

N70-12418# Groningen Rijksuniversiteit (Netherlands). Mathematisch Inst.
ANISOTROPIC MULTIGROUP TRANSPORT THEORY
J. Kenneth Shultis [1968] 29 p refs
(TW-63) Avail: AEC Depository Libraries

A method for solving various infinite-medium and half-space multigroup transport problems with anisotropic transfer is presented. A set of eigen-solutions for homogeneous multigroup equations is obtained and is shown to have full-range completeness and orthogonality properties. These properties then can be used to solve for the infinite medium Green's function. Half-space problems are solved in two distinct steps. First, the emergent distribution is calculated. Then, application of the full-range completeness property gives the complete solution everywhere in the half-space. The success of this method implies that the eigen-solutions also possess a half-range completeness property. Author (NSA)

N70-12434# RAND Corp., Santa Monica, Calif.
RECURSIVELY COUNTABLE SUBSETS OF RECURSIVE METRIC SPACES
N. Z. Shapiro Aug. 1969 17 p refs
(Contract F44620-67-C-0045)
(AD-693117; RM-6067-PR) Avail: CFSTI CSCL 12/1

The subset of a recursive metric space, M, is defined as recursively enumerable (r.e.) if it is the range of a recursive sequence of elements of M. It is recursively countable if it is a subset of an r.e. subset of M. It is known that if M satisfies certain conditions, the range of an effective map from a recursively

enumerable set of natural numbers into M is thin in the sense that its complement is dense in M. This study places conditions on a set I of natural numbers that will guarantee that the image of every effective mapping from I into M will be thin in that sense. Author (TAB)

N70-12438# RAND Corp., Santa Monica, Calif.
DIGITAL COMPUTER SIMULATION ESTIMATING SAMPLE SIZE
George S.Fishman Aug. 1969 64 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-693116; RM-5866-PR) Avail: CFSTI CSCL 12/1

The document discusses an algorithm for automatically estimating and collecting the sample size required for statistical precision in a computer simulation experiment while the simulation is running. The algorithm, which would be incorporated directly into the computer routines, would relieve an investigator of the burden of first estimating the variance of the sample mean from a data sample obtained from a trial run, then estimating the sample size necessary for the specified confidence interval, and finally collecting that many more observations in a successive simulation run. The underlying probability model is autoregressive; it would depend on an autoregressive representation of the sequence that considers each observation as a linear combination of past observations plus an uncorrelated random residual. This approach need not require more than 4 or 5 autocovariance computations to estimate the variance of the sample mean. A flowchart is included to aid in building the technique into simulation programs. Author (TAB)

N70-12442# RAND Corp., Santa Monica, Calif.
CHARACTERIZATIONS OF GAUSSIAN RANDOM PROCESSES BY REPRESENTATIONS IN TERMS OF INDEPENDENT RANDOM VARIABLES
Percy A. Pierre Aug. 1969 46 p refs
(Contract F44620-67-C-0045; Proj. Rand)
(AD-692702) RM-6092-PR) Avail: CFSTI CSCL 9/4

The report contains an investigation of certain classes of random processes having the same covariance function and some linear representations of those processes. The study considers various Gaussian and non-Gaussian models of random noise and shows that some of the most useful properties of the Gaussian model are not shared by physically reasonable non-Gaussian models. It is possible to define certain non-Gaussian processes as sums of a random number of random pulses. Necessary and sufficient conditions for the independance of linear functionals of these processes are obtained. Author (TAB)

N70-12444# Indiana Univ., Bloomington. Dept. of Mathematics.
ASYMPTOTIC GEVREY CLASSES AND THE CAUCHY PROBLEM FOR NON-STRICTLY HYPERBOLIC LINEAR DIFFERENTIAL EQUATIONS
Edward Newberger (Ph.D. Thesis) Sep. 1969 70 p refs
(Grant AF-AFOSR-1206-67)
(AD-693628; AFOSR-69-2331-TR) Avail: CFSTI CSCL 12/1

The notion of asymptotic Gevrey classes alpha, alpha > 1 is introduced. These classes are related to but distinct from the Gevrey classes used by J. Leray and Y. Ohya in connection with the Cauchy problem for a nonstrictly hyperbolic equation defined on a strip X in R sub (l+1), l = or > 1. A characterization of an asymptotic Gevrey class alpha is given in terms of conditions on the determining sequence of the class. To this end, the work of S. Mandelbrojt on classes of infinitely differentiable functions is extended to strips X and to the norms associated with these strips. Asymptotic Gevrey classes are then applied to a study of the Cauchy problem for a non-strictly hyperbolic linear differential equation on X. It is proved that if the coefficients of the differential operator, the non-homogeneous term, and the Cauchy data belong to certain asymptotic Gevrey classes alpha, then a solution exists on X which belongs to an appropriate Gevrey class alpha. Author (TAB)

N70-12461# Air Force Cambridge Research Labs., Bedford, Mass. Microwave Physics Lab.
THE WIENER-HOPF FACTORIZATION OF TWO BESSEL FUNCTION EXPRESSIONS
Robert A. Shore Apr. 1969 43 p refs *Its* Phys. and Mathematical Sci. Res. Papers No. 378
(AD-693131; AFCRL-69-0177) Avail: CFSTI CSCL 12/1

The Wiener-Hopf factorization of two Bessel function expressions is performed. The procedure used replaces the branch cut containing Hankel functions by a ratio of entire functions which, in a suitable limit, approaches the Hankel function ratio. The entire functions are then factored by the infinite product theorem and the limit of the factors taken to give the factors of the Hankel functions. These Bessel function expressions arise in the course of the analysis of the problem of a semi-infinite dipole antenna driven from a coaxial guide by a TE sub 11 mode. The analysis of this problem is the subject of a separate report. Author (TAB)

N70-12466# California Univ., Berkeley. Dept. of Mathematics.
CONTROLLABILITY IN NONLINEAR CONTROL SYSTEMS
John Norlin Johnson Jun. 1969 119 p refs
(Contract Nonr-222(88))
(AD-690914) Avail: CFSTI CSCL 12/1

For certain special types of control theory problems it is desirable to know whether there exists special control functions within certain specialized classes. This in effect is a question concerning the representation of functions. A result of this type is the major contribution of this research. Author (TAB)

N70-12507# Gosudarstvennyi Komitet Po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
UNITARY IRREDUCIBLE REPRESENTATIONS OF THE DE-SITTER GROUP O(2,3), PART 2
A. N. Leznov and T. A. Fedoseev 1968 11 p refs In RUSSIAN
(IFVE-STF-68-75) Avail: CFSTI

All the irreducible representations of the group SO(2,3) which possess the invariant hermitian form are found. Also an explicit expression is given for this form for all the cases. Author (NSA)

N70-12524*# Wyle Labs.,Inc., Huntsville, Ala. Research Div.
ESTIMATION OF DIRECT AND CROSS POWER SPECTRAL DENSITY OF DISCRETE DATA USING THE FAST FOURIER TRANSFORM
A. C. Jolly Mar. 1969 48 p refs
(Contracts NAS8-21060; NAS8-21026)
(NASA-CR-102369; WR-69-4) Avail: CFSTI CSCL 12A

The use of the averaged periodogram of a discrete, random function in estimating the direct (i.e., from a single random function) and cross power spectral density functions is described. Application of the algorithm known as the "fast Fourier transform" is suggested as the method of calculating Fourier coefficients and details of the numerical techniques involved in its derivation and use are given. The advisability of modifying the Fourier coefficients before converting to periodograms and averaging is pointed out and details of a suitable modifying function, expressed in both the time and frequency domains, are given. The method of converting the periodogram to power spectral density such that the integral of the latter function equals the mean square of the random function is derived, showing the requirement for an empirically determined factor. Finally, a digital filter is specified which is suitable for use in a filtering and decimation process that is applied to the calculation of power spectral density with a varying frequency resolution over the total frequency range of interest. Author

N70-12529# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EFFICIENT REALIZING OF BOOLEAN FUNCTIONS BY PRUNING NAND (NOR) TREES
B. E. White 2 Sep. 1969 49 p 2 Sep. 1969 49 p refs
(Contract AF 19(628)-5167)
(AD-693565; TN-1969-48; ESD-TR-69-244) Avail: CFSTI CSCL 9/5

A combinatorial tree structure composed entirely of NAND(NOR) blocks is pruned in a non-exhaustive fashion to yield minimal or near-minimal networks. It is assumed that complemented variables are not available and that there are no fan-in or fan-out limitations. The cost of a network is taken as being primarily determined by the number of logic blocks with the number of inputs and logic levels as secondary factors. The pruning algorithm lends itself to both hand methods and machine computation, although the synthesis procedure has not been programmed. Of the 68 nondegenerate functional equivalence classes of 3 variables, the minimum number of blocks results in 63 cases; only one more block in excess of the minimum is required in each of the other 5 cases. Author (TAB)

N70-12542# Atomic Energy Establishment, Winfrith (England). Control and Instrumentation Div.
ZIP MK 2: A FORTRAN CODE FOR CALCULATING THE EIGENVALUES (POLES AND ZEROS) AND FREQUENCY RESPONSES OF LARGE SETS OF LINEAR EQUATIONS REPRESENTING COMPLEX DYNAMIC SYSTEMS
Helen M. Sumner Mar. 1969 59 p refs
(AEEW-R-543) Avail: HMSO 8s 6d; BIS $1.70; CFSTI

The KDF9/EGDON program ZIP MK 2 is the third of a series of programs for off-line digital computer analysis of dynamic systems. It uses numerical algorithms and has comprehensive diagnostic sections to help the user in the event of faulty data or machine execution. ZIP MK 2 accepts mathematical models comprising first order linear differential and linear algebraic equations, and from these computes and factorizes the transfer functions between specified pairs of output and input variables. The model input scheme is fully compatible with the frequency response programs FRP MK 1 and MK 2, except that, for ZIP MK 2, transport or time-delays must be converted by the user to Pade or Bode approximations prior to input. ZIP provides the pole-zero plot (or complex plane analysis), while FRP provides the frequency response and FIFI the time domain analyses. Author (NSA)

N70-12555# Texas A&M Univ., College Station. Dept. of Chemical Engineering.
OPTIMAL CONTROL PROFILE SPECIFICATION FOR BOUNDARY VALUE SYSTEMS
J. T. Baldwin and L. D. Durbin Aug. 1969 40 p refs
(Contract N00014-68-A-0140)
(AD-693109; THEMIS-TR-17) Avail: CFSTI CSCL 7/1

The specification of the space-wise control profile to maximize a performance index for a distributed second order system with boundary conditions is achieved by reduction to a first order system with inequality constraints as terminal conditions and the application of a maximum principle formulation. Computation of the temperature profile to maximize intermediate product yield in a reactor with axial mixing is illustrated. Modified methods based upon the gradient of the Hamiltonian have been found to be highly effective for making successive approximations to the control profile. Author (TAB)

N70-12577# Akademiya Nauk URSR, Kiev.
LINEAR PREDICTION OF RANDOM PROCESSES
Ya. P. Dragan *In its* Methods for Collecting and Process. Inform. 1967 p 9–25 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

Problem solving methods for predictions of random processes are discussed using a linear analysis based on the covariation reproducing kernel. A formula is given for predicting random processes and root mean square errors. Conditions of indeterminance are also formulated. Transl. by E.C.

N70-12578# Akademiya Nauk URSR, Kiev.
EXAMPLE OF THE CONSTRUCTION OF A LINEAR PREDICTION
Ya. P. Dragan *In its* Methods for Collecting and Process. Inform. 1967 p 26–28 refs In RUSSIAN (See N70-12576 02-34)
Avail: CFSTI

A linear prediction of a random process is defined. The prediction was derived using a pulse shaping filter characterized by a first order differential equation. Transl. by E.C.

N70-12663# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN ADEQUACY THEOREM FOR AN OBJECT AND ITS RECOGNITION SYSTEM
T. Gergely 14 Jul. 1969 10 p refs Transl. into ENGLISH from Automatyka (Kiev), v. 12, no. 4, 1967 p 38–47
(AD-693595; FTD-HT-23-997-68) Avail: CFSTI CSCL 9/4

Application of the estimator theory (in mathematical statistics) to the selection of an optimal set of prototypes is considered; the optimum corresponds to minimum error and maximum resolution. The theorem reads: To obtain an optimal recognition, with a certain definite-criterion algorithm which is a measure of dispersion, it is necessary and sufficient to work out - during the recognition-system learning - an optimal set of prototypes, i.e., a set of such prototypes whose space is a most accurate model of the observation space and corresponds to the space of the external medium. It is demonstrated that the optimal set of prototypes is adequate to the external medium. In recognizing a check pattern, the recognition system uses only an active part of the entire set of prototypes. The potency of this active subset depends on the recognition-algorithm criterion. TAB

N70-12676# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
ANALYTICAL INVESTIGATION OF RESPONSE SURFACES (PROJECT SURF) Final Report
H. T. Mc Adams Sep. 1969 179 p refs
(CAL-RM-1741-P-1) Avail: CFSTI

Experiment design is considered in a framework which integrates mathematical and statistical techniques with the disciplinary background of the problem under study. Considered as a mapping from treatment space to response space, experimentation is viewed as a problem in mathematical extension of a function as well as a problem in statistical estimation. It is shown that existing experiment designs, born in the classical framework of polynomial approximation to a function, are not necessarily optimum when the experiment is viewed in the context of a general function space. A philosophy for broadening the scope of experiment design from this point of view is outlined and some techniques for its implementation presented. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N70-11416# Environmental Technical Applications Center (Air Force), Washington, D.C.
US NAVAL WEATHER SERVICE WORLD-WIDE AIRFIELD SUMMARIES, VOLUME 3, PART 3: UNITED STATES OF AMERICA, CENTRAL PLAINS

Sep. 1969 634 p refs
(AD-693491) Avail: CFSTI CSCL 4/2

The volume provides climatological summaries for airfields and climatic areas in the United States. Summaries are arranged according to numbered climatic areas, and by increasing WMO Station Index Numbers within the climatic areas. Maps are included to delineate areas and station locations. Climatological data is applicable only to a specified airfield. The data consists of statistical parameters based on actual weather observations made at the airfield. Author (TAB)

N70-11466# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

VERTICAL WIND COMPONENT ESTIMATES UP TO 1.2 KM ABOVE GROUND

Laurence J. Rider and Manuel Armendariz Jul. 1969 39 p refs
(AD-693252; ECOM-5258) Avail: CFSTI CSCL 4/2

Vertical wind components were computed up to 1.2 km from 37 wintertime and 10 summertime balloon observations between 0900 and 1200 local time utilizing the accurate and high resolution Cinetheodolite/Jimsphere system.
Cinetheodolite/Jimsphere system. The mean ascent rate of the Jimsphere was computed from all observations taken on a particular day. The ascent rate was found to be 5.16 m/sec for the winter and 5.10 m/sec for the summer months. The individual variations of a given observation from the mean ascent rate were assumed to be the vertical component. Variations in balloon ascent caused by variation in drag, anomalous variation in atmospheric density, balloon response to the wind, and aerodynamically induced motions are discussed. Vertical wind components ranged from 10-25 cm/sec in a stable atmosphere and 55-100 cm/sec under unstable conditions depending on wind speed. Author (TAB)

N70-11558# Joint Publications Research Service, Washington, D.C.

METEOROLOGY

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 208 17 Jul. 1969 p 6-15 refs (See N70-11554 02-30)
Avail: CFSTI

Abstracts of journal articles and books are presented, and a conference on general atmospheric circulation is reviewed. The topics covered include the following: characteristics of Baykal climate; air ionization measurements in June and July on the Riga and Vidzeme coasts; maps of thunderstorm activity determined from radar data; effect of cloud cover and wind speed on brightness of daytime sky over water; aerosol structure of troposphere and stratosphere; statistical characteristics of total radiation associated with cloud cover; influence of cities on meteorological conditions and external heat exchange between the earth's surface and the atmosphere; changes in earth's rotation and hydrological conditions in the North Atlantic; computer calculations of types of atmospheric circulation; numerical short-range forecasting methods; interlatitudinal exchange in the stratosphere; calculation of wind velocity profiles over water bodies; nonstationary light field in turbid medium illuminated with narrow light beam; thermal effect of radiation transfer in atomic oxygen line; and spectra of turbulent heat fluxes and momentum in the surface layer of the atmosphere.
N.E.N.

N70-11643# Joint Publications Research Service, Washington, D.C.

METEOROLOGY

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 211 3 Sep. 1969 p 10-16 refs (See N70-11641 02-30)
Avail: CFSTI

Methods for computing turbulent heat flux were compared, and an optimum method was formulated for computing various characteristics of turbulent exchange in the surface layer of the atmosphere based on gradient observations. The capabilities of present weather satellite systems are reviewed, and the establishment of an Antarctic base for launching meteorological rockets is reported. Weather and climate modification techniques are outlined. The development of an isotope generator to power remote weather stations, and of an aerosol sampling device is mentioned. Summary data are included on the use of special functions in formulating laws of distribution of geographical and hydrometeorological parameters; the vertical distribution of radon decay products in the atmosphere; and a method for predicting the position of the jet stream axis. M.G.J.

N70-11864# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.

A CRITICAL ANALYSIS OF NUMERICAL TECHNIQUES: THE PISTON DRIVEN INVISCID FLOW

Gino Moretti Jul. 1969 73 p refs
(Contract Nonr-839(38))
(AD-693037; PIBAL-69-25) Avail: CFSTI CSCL 20/4

A critical analysis of well-known procedures for the computation of one-dimensional shocked flows is made, in order to show the inconveniences of computing finite differences across a discontinuity and to prove that the use of the equations of motion in conservation form does not make the results any more accurate. A technique is developed to treat one-dimensional inviscid problems and it is applied to the problem of an accelerating piston. Practical and safe ways to predict the formation of a shock and to follow it up in its evolution are given. Author (TAB)

N70-11673# Joint Publications Research Service, Washington, D.C.

METEOROLOGY

In its Soviet Bloc Res. on Geophys., Astronomy, and Space, No. 209, 210 13 Aug. 1969 p 9-18 refs (See N70-11671 02-30)
Avail: CFSTI

Abstracted material is presented on Soviet meteorological research and observations. Weather forecasting, atmospheric contamination, hail suppression, spectral transparency, brightness of daytime sky, laser attentuation in fog, cloud physics, wind currents and velocities, and turbulent exchange over the sea are discussed.
N.E.N.

N70-11680# Weather Squadron (8th), Detachment 10, Westover AFB, Mass.

TERMINAL FORECAST REFERENCE FILE - WESTOVER AFB, MASSACHUSETTS, VOLUME 1

Aug. 1969 82 p
(AD-693558) Avail: CFSTI CSCL 4/2

A reference file for forecasters containing a description of the local area, climatology, discussion of weather regimes, rules of thumb and forecast studies. Author (TAB)

N70-11725# Army Natick Labs., Mass. Earth Sciences Lab.

RELATIONSHIP OF HOURLY DURATIONS TO THE DAILY MAXIMUM TEMPERATURE

Jane H. Westbrook Jun. 1969 17 p refs
(AD-693245; ES-48; TR-69-87-ES) Avail: CFSTI CSCL 4/2

Durations of temperatures within 10 F degrees of the maximum for 365 hot summer days from the upper midwestern United States are compared with those at Yuma, Arizona, and found to be similar. On only 30 percent of the observed days does the daily maximum temperature as recorded on a maximum thermometer appear in the hourly records. The hourly maximum temperature rarely persists for longer than 3 hours, while at 10 F degrees below the maximum, the average duration is approximately 10 hours.
Author (TAB)

N70-11730# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 205 4 Jun. 1969 p 20-34 refs (See N70-11728 02-13)
Avail: CFSTI

Summaries of meteorological investigations are presented. Hail prevention methods are reviewed and evaluated. Brief discussions are presented on errors in measuring precipitation and oblique visibility, high altitude and stratospheric circulation, atmospheric convection, air temperature analysis, cloud cover, air exchange between the troposphere and stratosphere, elastic and plastic deformation of snow, atmospheric models, synoptic maps, numerical weather forecasting, the Siberian darkness of 15 September 1938, and the distribution of river water in northern Lake Baykal.
N.E.N.

N70-11734# Joint Publications Research Service, Washington, D.C.
MISCELLANEOUS
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 205 4 Jun 1969 p 87-91 refs (See N70-11728 02-13)
Avail: CFSTI

News briefs are presented, including descriptions of May Day celebrations by scientic expeditions in the Arctic and Antarctica. The return of the deisel electric ship Ob' from Antarctica is also reported. A list of new members of the Soviet Academy of Sciences is given with the positions and accomplishments of each.
N.E.N.

N70-11920# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXCHANGE OF AIR MASSES BETWEEN THE STRATOSPHERE AND THE TROPOSPHERE IN THE NORTHERN HEMISPHERE
O. S. Berlyand et al 30 Jun. 1968 6 p refs Transl. into ENGLISH from Geofiz. Byul. (Moscow), no. 17, 1966 p 55-58
(AD-693526; FTD-HT-23-329-68) Avail: CFSTI CSCL 4/1

The article presents the results of an investigation of the mechanism of exchange of air masses between the troposphere and stratosphere for given mean annual distributions of temperature in the 0-16 km layer and the distribution of atmospheric pressure on the Earths surface by finding a wind velocity field for determining the vertical motion of air masses. It was calculated that during a year of air mass weighing 3.10 (superscript 14)T, which amounts to 5 percent of the weight of the entire atmosphere, descends from the tropopause in the 25-35 degree N zone. The weight of the 10-16 km air layer amounted to approximately 1/6 of the weight of the entire atmosphere. Thus, it is concluded that exchange of the entire air mass between the troposphere and stratosphere occurs within about 3.5 years in the 25-35 degree N zone.
Author (TAB)

N70-11933# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 31: PHILADELPHIA, PENNSYLVANIA INTERNATIONAL AIRPORT
Jun. 1969 32 p refs
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-31) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Philadelphia International Airport. Ceiling, visibility, wind, and weather information are grouped by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal.
Author

N70-11951# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
SNOW SIZE SPECTRA AND RADAR REFLECTIVITY
R. S. Sekhon and R. C. Srivastava 22 Sep. 1969 36 p refs Prepared in cooperation with IIT Res. Inst., Chicago
(Grant NSF GA-10639)
(TR-12) Avail: Issuing Activity

Some general properties of exponential particle size distributions are discussed. Especially significant are the corrections to the calculated liquid water content, precipitation rate, radar reflectivity, and median volume diameter resulting from truncations of the exponential size spectrum at maximum diameters less than infinity. These properties are used to analyze available snow particle size distribution data. It is concluded that the equation N sub D = N sub o exp (minus lambda D) describes the size distribution data for snow adequately. The equation N sub D delta D contains the concentration of snow particles of melted diameter D to D + delta D, and N sub o = 2500 R to the minus 0.94 power/mm/m to the minus 3 power, and lambda = 22.9 R to the minus 0.45 power/cm, where R is the precipitation rate in mm/hr. Equations were found for the precipitation content W, the median volume diameter D sub o, and the radar reflectivity factor Z. The large exponent in the Z-R equation is related to the fact that the effective size of the snow particle size distribution increases rather rapidly with the precipitation rate.
Author

N70-11978*# National Aeronautics and Space Administration, Washington, D.C.
LIGHT SCATTERING IN THE ATMOSPHERE, PART 2
A. I. Ivanov et al Nov. 1969 124 p refs Transl. into ENGLISH from the book 'Rasseyaniye Sveta v Atmosfere, Chast' 2' Alma Ata, Nauka Press, 1968 p 1-122
(NASA-TT-F-553) Avail: CFSTI CSCL 04B

Spectrophotometric studies of the brightness and polarization of the daytime sky, the scattering function, and other optical parameters of the atmosphere are discussed. A review of work on sky brightness is given, and direct observations and the result of comparing these data with theory are presented. The results of measurements of the scattering functions, the angular and spectral dependence of these functions, data on their variations and interrelationship, as well as the results of studies of atmosphere stability and transmittance, scattering functions, and optical thickness (total, aerosol and haze) are also presented. The reverse problem, determination of the aerosol spectrum from optical observations of the sky, is considered. The results of investigations of the spectrum of the large particle size fraction of the aerosol are given, the role of Aitken particles is evaluated, and the deviations from theoretical models of an aerosol with a Junge distribution of particle sizes are shown.
Author

N70-12025*# IIT Research Inst., Chicago, Ill.
COMPUTER PROGRAM FOR CROSSED-BEAM STUDIES OF CLEAR AIR TURBULENCE, PROGRAM DESCRIPTION (MLTCOR) Final Report, 14 May 1968 - 13 Aug. 1969
A. Wachowski and M. R. Phillips Sep. 1969 141 p refs
(Contract NAS8-21300)
(NASA-CR-61314; ITTRI-J6145) Avail: CFSTI CSCL 04B

The multichannel correlation program described in this report is fairly general and was developed to calculate statistics for aerodynamic and atmospherical turbulence based on the crossed beam technique. The piecewise concept was used in writing this program. A long-time series is logically broken up into a series of smaller pieces. Correlations, mean values, root mean square values, and variances are then calculated for each piece along with their standard statistical errors. A dynamic storage allocation scheme was used in the program to provide maximum storage for data and to avoid the use of fixed length data arrays. Correlations can be performed on essentially infinite length records. Time series data

are brought into the computer in blocks to fill the available storage, and data for the maximum time lag are saved from the previous block to make correlations continuous across the core loads of data. The program is written in FORTRAN 4 using modular techniques and dynamic storage allocation. Author

N70-12129# Joint Publications Research Service, Washington, D.C.
STUDIES OF PHYSICS OF THE UPPER ATMOSPHERE AND METEOROLOGICAL RESEARCH
In its Upper Atmosphere and Space Res. in the USSR in 1968 1 Aug. 1969 p 23-37 (See N69-12126 02-30)
Avail: CFSTI

Rocket studies of the upper atmosphere covered in addition to measurements of density and temperature, partial pressure and temperature of molecular nitorgen and neutral components, measurements on ion concentration in the thermosphere and absorption in the Lyman-alpha line. G.G.

N70-12204*# Northrop Corp., Huntsville, Ala.
CAPE KENNEDY PEAK WIND PROFILE PROBABILITIES FOR LEVELS FROM 10 TO 150 METERS
J. L. Wood and W. Alan Bowman Sep. 1969 70 p refs Prepared by Lockheed Missiles and Space Co., Huntsville, Ala.
(Contract NAS8-20082)
(NASA-CR-61308) Avail: CFSTI CSCL 04B

Peak wind statistics for levels up to about 150 m for Cape Kennedy are presented for use in establishing design criteria for space vehicles and facilities. From distributions of peak winds at 10 m and a conditional equation relating winds at levels between 10 and 152.4 m, a bivariate distribution function is integrated to provide: (1) cumulative probability distributions of peak winds for seven different levels and eleven different exposure periods, and (2) cumulative joint probability distributions of peak winds at a reference level and individual peak-wind profiles between 18.3 and 152.4 m. The cumulative distribution curves for all levels (10, 18.3, 20.5, 61.0, 91.4, 121.9 and 152.4 m) and all exposure periods (1 hour and 1, 2, 5, 10, 15, 30, 60, 90, 180 and 365 days) possess the double-exponential shape, characteristic of extreme-value distributions. This feature is illustrated and results are summarized in tables of the two distribution parameters, computed from each curve. Results indicate that the probability of a wind value not being exceeded decreases both with increasing height and exposure period. Author

N70-12373# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET, VOLUME 33 Final Report
Jun. 1969 32 p refs
(Contract FA-67-WAI-129)
(SRDS-RD-69-22-Vol-33) Avail: Issuing Activity

The tables contained herein have been prepared and organized for use in evaluating the cost/benefits of all weather landing systems and fog dissipation techniques. Thus, the time intervals of duration of the categories of weather are significant in determining the times of the delay, diversion or cancellation of an aircraft flight resulting from a restricted weather category. This information together with the number and types of aircraft affected by the restricted weather and the costs of a delay, diversion or cancellation combine to provide the total costs resulting from the weather restrictions. Climatological summaries have been prepared for 41 airports. Their location and associated volume numbers are listed. Author

N70-12486# Weather Wing (2nd), APO 332, New York.
CYCLONES AND ANTICYCLONES IN EUROPE
Robert E. Black 1 Sep. 1969 72 p refs
(AD-692-731; TN-2WW-69-2) Avail: CFSTI CSCL 4/2

Numerous studies, dating from 1783, have been conducted on cyclone and anticyclone paths. The study discusses movement and generation of pressure centers, both cyclones and anticyclones, from a theoretical and climatological point of view. It discusses, by month, the pressure system paths over Europe areas of genesis and the relationship of paths to 500-MB circulation. Cyclogenesis on the Lee side of a terrain barries is discussed in light of the conservation of potential vorticity. Pettersen's development formula is used to show the effect of land-locked bodies of water on genesis of pressure systems. Cyclone and anticyclone tracks vary from season to season, month to month. The tracks, shown on charts, are discussed in light of these variations. There are favored latitudes for cyclogensis 40, 49-57, and 70 N and anticyclogenesis 45 N as well as favored areas. The areas and factors affecting genesis are discussed. Author (TAB)

N70-12526 National Lending Library for Science and Technology, Boston Spa (England).
AN ASSESSMENT OF THE RELIABILITY OF CHARACTERISTICS OF UNDERESTIMATION OF SOLID PRECIPITATION DUE TO WIND
E. G. Bogdanova [1969] 25 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 215, 1968 p 114-124
(NLL-M-7516-(5828.4F) Avail: Natl. Lending Library, Boston Spa, Engl.

The possible sources of error are determined for the function K sub s = f(u sub 2, t sub s), where u sub s is the wind speed during a snowfall at the surface level of the preciptation gage, and t sub s is the air temperature. The gages were placed in open spots to assess the magnitude of the errors which may be caused by precipitation blowing into the gage during driving snowstorms. Gages were also placed in sheltered spots to determine the effect of additional precipitation blowing from surrounding tree tops, roofs, etc. No effects on the value of K sub s were observed in either case. However, it was found that if wind speed at a sheltered spot is not considered, K sub s is underestimated by 25% to 35% of the measured amount of precipitation. The calculated functions K sub s(u,t) were compared with observations at an experimental base. The results show good agreement between corrected amounts of snow measured in sharply differing wind regimes by gages set up at points sheltered to sharply differing extents. M.G.J.

N70-12545# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS, AUGUST 1969 [OBSERVATIONS CLIMATOLOGIQUES, AOUT 1969] Monthly Bulletin
1969 15 p In FRENCH and DUTCH
Avail: CFSTI

Climatological data derived from observations made at the Royal Belgian Meteorological Institute, Uccle (Belgium) in August 1969 are given. ESRO

N70-12558# Weather Wing (7th), Scott AFB, Ill.
LOCAL ANALYSIS PROGRAM Final Report
Bryan G. Falzgraf 10 Sep. 1969 11 p
(AD-692732; Rept-7WWP-105-9; Rept-7WWTN-1) Avail: CFSTI CSCL 4/2

The report presents a discussion of the desirability of a local analysis program in Air Force base weather detachments with some recommendations for setting up such a program and a suggested SOP covering such an activity. Author (TAB)

N70-12572*# National Aeronautics and Space Administration, Washington, D.C.
STRATOSPHERIC SYNOPTIC DENSITY MAPS FOR

1964-1965 AND FOR THE WARMING EVENT OF DECEMBER 1967

Nov. 1969 52 p refs Prepared by Natl. Meteorol. Center, Upper Air Branch

(NASA-TM-X-1903) Avail: CFSTI CSCL 04B

Constant-heights synoptic density maps of the western portion of the Northern Hemisphere are presented for two stratospheric levels, 30 and 40 km. Temperature and pressure data are also included. The maps are for 1964-1965 and for the stratospheric warming event of December 1967-January 1968. They are at four-weekly intervals, except in January and during the stratospheric warming, for which maps at more frequent intervals are presented. A discussion is included of typical and unusual density patterns, and of interactions in the fields of pressure, temperature, and density. Density changes associated with both minor and major stratospheric warmings are described. In association with the major stratospheric warming at the end of 1967, density increases by 40% at 30 km, and by 80% at 40 km, were noted in the polar area. Author

N70-12604# Weather Bureau, Silver Spring, Md. Space Operations Support Div.

A SATELLITE ANALYSIS OF TWIN TROPICAL CYCLONES IN THE WESTERN PACIFIC

James L. Cox (ESSA, Washington, D.C.) and Gilbert Jager (ESSA, Washington, D.C.) Oct. 1969 29 p refs

(ESSA-TM-WBTM-SOS-5) Avail: CFSTI

The unique role satellite cloud photographs play in providing meteorologists with an important tool for studying tropical disturbances in various stages of their life cycles and their related environments is illustrated. Satellite derived data, particularly cirrus-level wind estimates from cloud photographs, are used to recount the story of Annie and Gilda. It is the change which takes place in the cirrus-level wind field that enables the meteorologist to discern the step by step development of the respective cyclones as well as the interaction between the high level winds of the two hemispheres and the twins themselves. Gilda, the Northern Hemisphere twin, formed near the equator in an area initially under an apparent weak cirrus-level anticyclonic flow over which clear skies prevailed. As Gilda developed its own anticyclonic outflow aloft, the high-level flow into the tropical westerlies diminished and the flow toward the equator increased. Part of the flow crossed the equator, then recurved toward the east to produce a weak anticyclonic flow at the cirrus level in the Southern Hemisphere over an area of partly cloudy skies, thus setting the stage for the formation of Annie. Author

N70-12698# Naval Postgraduate School, Monterey, Calif.

AN ANALYSIS OF A SEVERE LOCAL STORM USING ISENTROPIC TRAJECTORIES Final Report

Ronnie L. Alberty and Kenneth Lee Van Sickle Aug. 1969 137 p refs Sponsored by Naval Weapons Center

(AD-693046; NPS-51A19081A) Avail: CFSTI CSCL 4/2

One and one-half hour isentropic trajectories obtained from an objective computer technique for the 308K, 312K, 320K and 332K isentropic surfaces are investigated for the May 28, 1967, severe local storm case in the National Severe Storm Laboratory (NSSL) network. In conjunction with the trajectories, air parcel properties of vertical motion, acceleration, divergence, vorticity, static stability and total energy have been studied with respect to development, growth, movement and decay of the storm system. Basic assumptions are that the flow is frictionless and adiabatic over the entire grid. The results show that the observed winds do provide some skill in formulating isentropic trajectories which demonstrate the presence of storm activity in the specific region. The investigation of a mesoscale inertial-gravity wave having a wave length of 150 KM, period of 3 hours and phase speed of 14 m/sec is also presented, with its possible correlation to the onset of the severe storm. Author (TAB)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N70-11453# Southern Methodist Univ., Dallas, Tex. Information and Control Sciences Center.

AUTOMATIC NAVIGATION Interim Scientific Report, 1 Sep. 1968 – 31 Aug. 1969

Andrew P. Sage 31 Aug. 1969 64 p refs

(Contract F44620-68-C-0023)

(AD-693221; AFOSR-69-217-TR) Avail: CFSTI CSCL 17/7

This interim scientific report summarizes activities in Optimization and Estimation Theory with applications to communications and control and with special emphasis on Automatic Navigation under Air Force Office of Scientific Research Contract F44620-68-C-0023 during the period September 1, 1968 through August 31, 1969. Author (TAB)

N70-11507# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STATUS OF AIR-TO-AIR GUIDED MISSILES

Hsiang-Hsin Ho 20 Jun. 1969 6 p Transl. into ENGLISH from Hang K'ung Chih Shih, v. 2, no. 3, 1965 p 26 – 28

(AD-693478; FTD-HT-23-918-68) Avail: CFSTI CSCL 17/7

The paper introduces some modern air-to-air guided missiles and divides them into three categories: those equipped with fully automatic guidance control system, those equipped with semi-automatic guidance control system, and those equipped with heat-seeking guidance system. Examples are given under each category. In addition, there are also those adopting a combination of radar and infrared guidance system, and those guided with radar. The paper then outlines the general characteristics of air-to-air missiles with regard to their explosives, motive power, sizes, controlling systems, and launching systems; and the general trend of their development, including improving their ability to hit more targets, increasing their range, improving their control systems, and increasing their explosion power. Finally, the paper explains the general shortcomings of this type of missiles. Twelve technical drawings on different air-to-air missiles and three photos are provided. Author (TAB)

N70-11656*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.

OPTIMUM MIXING OF INERTIAL NAVIGATOR AND POSITION FIX DATA

Walter M. Hollister and Michel Claude Brayard Aug. 1969 41 p refs

(Contract NAS12-2081)

(NASA-CR-86271; RE-62) Avail: CFSTI CSCL 17G

The filtering problem is studied analytically for a system composed of an inertial navigator giving continuous indication of position and velocity and an external position fixing device giving continuous or discrete positional information. Accelerometer and external position errors are represented by white noise. Gyro drift is represented by a random walk process. Reasonable approximations lead to simplified models plus analytic predictions of the filter's performance. The analytic results are verified by comparison with computer simulations using more accurate models. Error growth of the inertial navigator without external information is shown to be

extremely small for the first eight minutes following alignment. During that interval accelerometer noise is the predominant source of error. Estimation of the platform misalignment is not necessary unless the inertial system must subsequently navigate without external position information. Author

N70-11719# Army Foreign Science and Technology Center, Washington, D.C.
ERRORS IN GYRO DEVICES
Ya. L. Lunts 1969 272 p refs Transl. into ENGLISH from the Russian
(AD-693229; FSTC-HT-23-134-69) Avail: CFSTI CSCL 17/7

The book is dedicated to the analysis of errors in gyroscopic instruments arising due to rocking of the support base and for other reasons resulting from oscillations of the sensing elements. Nonlinear effects are analyzed and described by equations of second approximation. In many cases, precise equations of movement of the gyroscopic instrument can be investigated. Errors such as shifts and zero drift are determined for various gyroscopic devices for regular and irregular rocking. In the latter case, external excitations are assumed to be random functions of time. The book is designed for engineering-technical and scientific workers, but also may be used as a text for senior students and post-graduate students specializing in the area of applied gyroscopy. Author (TAB)

N70-11735*# Bellcomm, Inc., Washington, D.C.
ATTITUDE CONTROL FOR AAP 1/2 AND AAP 2/3A Progress Report
J. J. Fearnsides 10 Mar. 1969 20 p refs
(Contract NASw-417)
(NASA-CR-106962) Avail: CFSTI CSCL 17G

Preliminary results are presented for a thrustor firing control law for holding X-POP attitude in missions AAP 1/2 and AAP 2/3A. It is shown that significant reductions in the number of thrustor ignitions and in the amount of propellant consumption can be achieved if a control strategy is used in which the gravity-gradient and aerodynamic torques produce a bounded oscillatory attitude motion about all three spacecraft axes. Author

N70-12027*# Honeywell, Inc., Minneapolis, Minn. Inertial Components Group.
STRAPDOWN MINIATURE ELECTROSTATIC GYRO (SDMEG) DEVELOPMENT AND EVALUATION Final Report, 1 Jun. 1965 - 28 Mar. 1969
John C. Wacker Mar. 1969 163 p refs Prepared for JPL
(Contract NAS7-100; JPL-951149)
(NASA-CR-106989; Rept-20302-FR) Avail: CFSTI CSCL 17G

A study program was initiated to determine the feasibility of implementing a strapdown electrically suspended gyro (SDMEG) in an attitude reference system for a spacecraft. The concept of the SDMEG featured a suspension system capable of low-power operation in a low-g environment and an approach toward automatically starting the gyro in space. New technological advances were employed to successfully miniaturize some of the critical subsystems of the gyro. Tests show that the SDMEG is capable of starting under automatic control, of operating in moderate temperature ranges, and of maintaining suspension in expected space acceleration environments, even in a low-power mode of suspension operation. Techniques for calibrating critical readout parameters, a theoretical torque model which predicts the drift behavior of the SDMEG, and a technique for calibrating the coefficients of the torque model from test data were also developed. Author

N70-12117*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THEORY OF INERTIAL NAVIGATION: AIDED SYSTEMS
V. D. Andreev 1969 424 p refs Transl. into ENGLISH of the book "Teoriya Inertsialnoi Navigatsii: Korrektiruemye Sistemy" Moscow, Izd. Nauka, 1967 Published for NASA and NSF /ts Cat. No. 5444
(NASA-TT-F-564; TT-69-55027) Copyright. Avail: CFSTI CSCL 17G

The general aspects of the application of external guidance information, and the theory of inertial systems where an altimeter provides additional information on the distance of the moving object from the earth's surface are considered. Tuned gyropendulum systems and various gyroscopic instruments are discussed with emphasis on the dynamic analogy between the Schuler-tuned gyropendulum systems and the two accelerometer inertial guidance systems. Astronomical correction procedures, whereby telescopes are used to fix directions to certain stars, are presented. The dynamics of autonomous and aided inertial systems with random errors are analyzed as functions of the statistical characteristics of the navigation instruments errors. F.O.S.

N70-12153# Naval Postgraduate School, Monterey, Calif.
INSTALLATION AND EVALUATION OF LORAC PRECISE NAVIGATION SYSTEM
Richard Eugene Shrum (M.S. Thesis) Dec. 1968 105 p refs
(AD-693047) Avail: CFSTI CSCL 17/7

A navigation system was established on Monterey Bay using the LORAC principle of phase-comparison. It is intended primarily for use in ocean sciences research within a 25 mile radius of Moss Landing, California. The system offers the capability of repeating a previously held position within a few feet, and may be used as a general navigation aid in the area with accuracy on the order of 100 yards. The theory of operation and error-causing factors are discussed in detail. Transmitter and receiver installations are described. Chapter IV is intended to serve as a self-contained users guide, with instructions on the operation of the receiver, suggested techniques for use, and a description of the performance to be expected. A computer program is included to provide grid charts with hyperbolic position lines plotted for any desired area or scale. Brief initial testing indicated a high degree of stability and repeatability, however further evaluation over a longer period is necessary. Author (TAB)

N70-12546# Collins Radio Co., Cedar Rapids, Iowa.
COMPUTER/SIMULATION STUDY OF AIR-DERIVED SEPARATION ASSURANCE SYSTEMS IN MULTIPLE AIRCRAFT ENVIRONMENT
J. M. Holt and G. R. Marner Oct. 1969 85 p ref
(Contract FA-WA-4598)
(SRDS-RD-69-31) Avail: Issuing Activity

Some problems of airborne collision avoidance are identified and, where possible, a course of action that seems promising is recommended. Forthcoming changes to air traffic control procedures and the possibility of automatic ground-based collision avoidance require further studies in development of a horizontal maneuver strategy, a more precise treatment of aircraft acceleration, sharper altitude maneuver logic, optimum data smoothing, collision avoidance systems influence on runway acceptance rates, the inference of intervention and collision rates from systems specification, and development of a multistaged intervention philosophy. Author

N70-12611*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MAGNETIC POSITION DETECTION METHOD AND APPARATUS Patent Application
John V. Foster inventor (to NASA) Filed 20 Jun. 1969
(NASA-Case-ARC-10179-1; US-Patent-Appl-SN-835058) Avail: CFSTI CSCL 17G

The invention relates generally to a method and apparatus

for establishing the position of an aircraft or other vehicle with reference to a predetermined set of coordinates and, more particularly, to a method and apparatus using magnetic field techniques for accurately establishing the position of an aircraft relative to a landing strip and/or a predetermined glide path and instantaneously providing communicative data responsive thereto. In accordance with the invention, magnetic field sources are used to "mark" an aircraft runway and one or more magnetometers are situated in the aircraft. The signals from the magnetometers are processed to provide the pilot position information when landing.
NASA

N70-12681# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE FORMULATION OF THE PROBLEM OF SYNTHESIZING NAVIGATION SYSTEMS
M. D. Ageev 1969 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Tverd. Tela (Moscow), no. 4, 1969 p 53–56
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Linear operators used in error analysis of navigational gyroscopic systems are examined in their relation to optimal processing of navigational information. The synthesis of these operators is resolved by approximation methods. Transducer error, equations of ideal system operation, optimal filtration theory, the effects of object motion, object control system properties, and a final relationship, which contains nonlinear terms and nondiagonal elements, are discussed as steps in the process of realizing the optimal operator.
M.H.E.

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N70-11485*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SNAP-8 NaK-PUMP-MOTOR-ASSEMBLY 400 HERTZ START TESTS
Fred Boecker 24 Nov. 1969 17 p refs
(NASA-TM-X-52723) Avail: CFSTI CSCL 18N

Two hermetically-sealed induction motor-driven centrifugal pumps were tested to determine their ability to start on 400 hertz power in eutectic sodium–potassium mixture loops at 70 to 1300 F. The NaK flow resistance was preset by a flow control valve prior to each start and corresponded to NaK flow rates after pump start from zero to 40,000 lb/hr. The two pumps started successfully on 400 hertz power when the induction motor stator temperatures were 300 and 480 F with NaK pump inlet temperatures of 115 and 1300 F, respectively. Both pumps experienced startup difficulties when the motor stator temperatures were 70 to 140 F with NaK at the pump inlet at temperatures ranging from 70 to 600 F.
Author

N70-11601# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISTRIBUTION OF RADIATION APPEARING IN A SLIT DURING DIRECT TRANSMISSION FROM A CIRCULAR PLANE SOURCE
V. S. Anastasevich 22 May 1969 6 p refs Transl. into ENGLISH from Vopr. Dozimetr. i Zaschity ot Izluchenii, Mosk. Inzh. Fiz. Inst. (Moscow), no. 8, 1967 p 78–83
(AD-693515; FTD-HT-23-61-69) Avail: CFSTI CSCL 18/6

The derivation of formulas for the calculation of the emission current from an isotropic source as well as the emission flux and current from a cosinusoidal source at any point of the slit is given. In addition to those formulas derived for the cosinusoidal source, a formula for the total emission current along the axis through any cross section of the slit was obtained.
TAB

N70-11900*# General Electric Co., Philadelphia, Pa. Isotope Power Systems Operation.
A DESIGN STUDY FOR A THERMIONIC REACTOR POWER SYSTEM FOR A NUCLEAR ELECTRIC PROPELLED UNMANNED SPACECRAFT Quarterly Progress Report, 4 Feb. – 5 May 1969
23 May 1969 74 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952381)
(NASA-CR-106993; GESP-7011; QPR-1) Avail: CFSTI CSCL 21F

The technical progress of a design study program on thermionic reactor power systems for nuclear electric propelled, unmanned spacecraft is discussed. The purpose is to provide designs of selected thermionic power systems integrated with nuclear electric unmanned spacecrafts over the range of 70 to 500 kWe. The basic program task structure and key guidelines are presented. Detailed characteristics of the mercury ion thruster, science payload and communications subsystems are given. Titan 3 C/7 launch vehicle restraints on shroud size and payload capability are discussed, and a point-of-departure 300 kWe powerplant design concept is developed in sufficient detail to permit initiation of preliminary analyses of spacecraft weight distributions and activated coolant dose rates. An evaluation of heat rejection systems shows that a two-loop system (the reactor coolant loop in series with the radiator coolant loop, with an intermediate heat exchanger) is approximately 550 pounds heavier than a single-loop system. A coolant activation analysis, based upon a bonded wet cell trilayer reactor powerplant, demonstrates that the two-loop spacecraft power system is required.
Author

N70-11916# National Accelerator Lab., Batavia, Ill.
DESIGN PROGRESS AT THE NATIONAL ACCELERATOR LABORATORY, 1968 – 1969
M. S. Livingston 30 Jun. 1969 41 p refs Sponsored by AEC
(NAL-26) Avail: CFSTI

The continuing changes in design of the 200-GeV accelerator and its associated facilities are described for the historical record.
Author (NSA)

N70-11975*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STUDY OF A 300-KILOWATT RANKINE-CYCLE ADVANCED NUCLEAR-ELECTRIC SPACE-POWER SYSTEM
Jack A. Heller, Thomas A. Moss, and Gerald J. Barna Washington Nov. 1969 37 p refs
(NASA-TM-X-1919; E-5135) Avail: CFSTI CSCL 21F

A system analysis is presented for a nominal 300 kW electric potassium system employing a lithium-cooled fast reactor and with 2100 F (1420 K) turbine inlet temperature. Trends in performance and weight are discussed for variations in design parameters. Performance and design of major components are reviewed, including material considerations. A typical conceptual system layout is shown.
Author

N70-11988# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
NUMERICAL METHODS OF SEVERAL NUCLEAR DIFFUSION CODES AND OF REACTOR LIFE
A. Daneri 1969 43 p refs In ITALIAN
(RT/FIMA-(69)1) Avail: AEC Depository Libraries

The two-group neutron diffusion equations, delayed neutron

equations, and precursor equations for description of reactor core neutronics are presented; eigenvalue solutions to these equations are given. Characteristics of the following diffusion codes are summarized: SQUID-1, SQUID-2 pi, SQUID-360, ERFBUS, TRITON, and CoNDoR. Geometric representation, calculation of self-shielding factors and macroscopic cross sections and burnup, or depletion, calculations are discussed. The finite differences and iterative methods for solution of the diffusion problems are outlined. NSA

N70-12014# Nuklear-Chemie und -Metallurgie, G.m.b.H., Wolfgang Bei Hanau (West Germany).
IFA-27 EXPERIMENT TO STUDY VIBRATORY COMPACTED URANIUM DIOXIDE IRRADIATION PERFORMANCE
R. Sieber Lillestrom, Norway Haldan Reaktor Prosjekt, Institutt for Atomenergi Jan. 1969 40 p refs
(HPR-105) Avail: CFSTI

The experimental fuel assembly IFA-27 was irradiated in the HBWR. The experimental assembly contained 4 vibratory compacted and 3 pelletized UO2-fuel rods with Zircaloy-2 cladding. The seven rod cluster with a hexagonal lattice and a pitch of 23 mm was designed to produce an average of 600 W/cm fuel length. After 9 days of operation at average power levels up to 663 W/cm, cladding failures occurred on the vibratory compacted fuel rods. After an additional operation for 6 days at power levels up to 683 W/cm all 4 vibratory compacted fuel rods had failed. A visual inspection of the fuel rods revealed a total of eleven similar cladding failures. In all cases the failures were associated with extremely localized cladding expansions which ranged approximately from 0.3% to 1.9% of the original outer diameter. The cladding defects are explained as the consequence of localized hydrogen pickup at the inner cladding surface and the action of a mechanical load on the cladding. Author (NSA)

N70-12030# Hittman Associates, Inc., Columbia, Md.
PM PLANT INTERFACE STUDY, TYPE 4 CORE, VOLUME 1
19 Mar. 1969 64 p refs Prepared by Union Carbide Corp. for AEC
(Contract W-7405-eng-26)
(HIT-329-R-Vol-1) Avail: CFSTI

The Type 4 replacement core for the PM-1 and PM-3A plants uses low enrichment UO2 fuel instead of the fully enriched cermet fuel used in previous cores. The Type 4 core fits within the physical envelope dimensions of previous PM cores but is heavier. Its weight is 3250 pounds; the Type 2 core weight was 1685 pounds. The additional weight required investigation of all the refueling tools, refueling systems and core component removal equipment for structural adequacy. In addition, since the Type 4 core has different thermal design characteristics, decay heat removal in the spent fuel tank was investigated. The analyses and redesign, where required, of each component in the refueling sequence are described. Stress analysis results and recommendations and final design assembly drawings for each component requiring modification are presented. Author (NSA)

N70-12031# Hittman Associates, Inc., Columbia, Md. Union Carbide Corp., Oak Ridge, Tenn.
PM PLANT INTERFACE STUDY, TYPE 4 CORE, VOLUME 2
19 Mar. 1969 190 p refs Prepared by Union Carbide Corp. for AEC
(Contract W-7405-eng-26)
(HIT-329-R-Vol-2) Avail: CFSTI

Stress analyses for the recommended modifications of PM-1 and PM-3A equipment to accommodate Type 4 cores are presented. A specification for a 3 ton auxiliary crane is included. Author (NSA)

N70-12032# Washington Univ., St. Louis, Mo.
CYCLOTRON UTILIZATION, OPERATIONAL ACHIEVEMENTS, AND IMPROVEMENTS Summary Technical Progress Report, Year Ending 31 May 1969
16 Jul. 1969 18 p
(Contract AT(11-1)-1760)
(COO-1760-2) Avail: CFSTI

Development and operation of the Washington University cyclotron from June 1, 1968, to May 31, 1969, are summarized. Author (NSA)

N70-12035# Technische Hochschule Munchen (West Germany). Inst. fuer Thermodynamik.
TRANSIENT BEHAVIOR OF A PRESSURIZED WATER REACTOR [INSTATIONAERES VERHALTEN EINES DRUCKWASSERREAKTORS]
K. Riedle May 1969 161 p refs In GERMAN; ENGLISH summary
(BMWF-FBK-69-14) Avail: AEC Depository Libraries

The transient behavior of a pressurized water reactor was described using the basic conservation laws for mass, energy and momentum, and the kinetic equations for neutrons. This system of coupled differential equations was solved by the method of finite differences on a computer (IBM 360/40), so that for an arbitrary perturbation function which forces the reactor to deviate from steady state, the response of the reactor can be calculated. Author (NSA)

N70-12115# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
PRESSURE RESPONSES OF PWR CONTAINMENTS: A PARAMETRIC ANALYSIS
D. C. Slaughterbeck Jun. 1969 28 p refs
(Contract AT(10-1)-205)
(IDO-17300) Avail: CFSTI

CONTEMPT (a computer program for predicting the pressure-temperature response of a dry containment building to a loss-of-colant accident) was used to analyze pressure responses in containment buildings of large pressurized water reactors under a wide range of conditions and assumptions. The analysis provides quantitative information on the sensitivity of parameters for use in the safety evaluation of reactor power plants. The results show the importance of break size and heat transfer during the blow-down of the reactor vessel and show how the action of emergency core cooling systems and subsequent additions of energy control the response during the postblowdown period. Also, the results show that containment safety systems are required to operate after blowndown to limit the pressure to a value below the design pressure. Author (NSA)

N70-12157# Institute of Physical and Chemical Research, Saitama (Japan).
MACHINE OPERATION
In its IPCR Cyclotron, Vol. 2 1968 p 2-6 (See N70-12156 02-24)
Avail: CFSTI

Scheduled machine times for two periods of operation during the reporting year are tabulated, indicating the type of research for each interval. A successful shutdown, required to obtain higher dee-voltages and to accelerate heavy ions steadily, is also reported. A.C.R.

N70-12158# Institute of Physical and Chemical Research, Saitama (Japan).
MACHINE DEVELOPMENT
In its IPCR Cyclotron, Vol. 2 1968 p 7-18 refs (See N70-12156 02-24)
Avail: CFSTI

Machine improvements and additional added features achieved during the reporting period are described. Improvements included an increase in dee voltage capability, a new vacuum condenser incorporated in the oscillator housing, installation of a second He-3 recirculating system, and development of a modified-cone supporting tube for the ion source. A multicharged, heavy ion source was constructed for the cylotron according to a design based on results of an earlier bench test. This type of source is primarily characterized by an electron-bombarded cathode; it is reported that operating life was limited by upper cathode erosion which depended greatly on alignment of the arc axis in the magnetic field. Finally, the installation and operating characteristics of a focusing magnetic channel in the acceleration chamber are briefly treated. A.C.R.

N70-12162# Institute of Physical and Chemical Research, Saitama (Japan).
NUCLEAR INSTRUMENTATION AND TECHNIQUES
In its IPCR Cyclotron, Vol. 2 1968 p 112-120 refs (See N70-12156 02-24)
Avail: CFSTI

A polarized ion source for installation in the cyclotron is described; its main characteristics are: (1) dissociation of H-2 by an RF discharge at a low pressure of 0.4 mmHg; (2) collimation of H atoms through a multichannel pyrex nozzle; and (3) separation of atomic states in a 40-cm, sextupole magnet with a magnetic field strength of 7.5 kG. An electrical detection and recording system used with a broad-range magnetic spectrometer is presently under development. A charge spectrometer whose primary technical features include the source volume and the ion detection system using pulse counting techniques was tested. The detector used in the tests was a Cu-Be 10-stage particle multiplier, and the results indicate that the gain of the multiplier varies strongly with the kind of ion being studied. A.C.R.

N70-12165# Institute of Physical and Chemical Research, Saitama (Japan).
SOLID STATE PHYSICS
In its IPCR Cyclotron, Vol. 2 1968 p 145-155 refs (See N70-12156 02-24)
Avail: CFSTI

The behavior of helium bubbles in stainless steel reactor components was studied by gamma-particle irradiation, followed by observation of the bubbles by a transmission electron microscope. Preliminary experiments on the Mossbauer effect on Ni-61 magnetic properties are also reported. A description is provided of gamma-ray goniometer for positron annihilation investigations; the system is designed to determine angular correlation of two gamma rays arising from annihilation of polarized positrons with electrons under ferromagnetic conditions, so as to detect changes in the correlation. Preparation of positron sources for annihilation experiments is also treated. Ni-57 and Co-55 were produced as positron sources for the angular correlation experiments on ferromagnetic metals and alloys. A.C.R.

N70-12167# Institute of Physical and Chemical Research, Saitama (Japan).
RADIATION MONITORING
In its IPCR Cyclotron, vol. 2 1968 p 163-169 refs (See N70-12156 02-24)
Avail: CFSTI

The operation and performance of a large neutron counter at a distance of about 85 m from the cyclotron facility is described, and peak intensities of neutrons detected are plotted as a function of the deflected beam current. Results of recent measurements on intensities of neutron leakage in the controlled working area of the facility are presented, including the nuclide character of the residual activity, as well as internal and external exposures of workers. A.C.R.

N70-12178*# General Electric Co., Philadelphia, Pa. Isotope Power Systems Operation.
A DESIGN STUDY OF A THERMIONIC REACTOR POWER SYSTEM FOR A NUCLEAR ELECTRIC PROPELLED UNMANNED SPACECRAFT Quarterly Progress Report, 5 May - 5 Aug. 1969
20 Aug. 1969 137 p refs Prepared for JPL
(Contracts NAS7-100); JPL-952381)
(NASA-CR-107008; GESP-7013; QPR-2) Avail: CFSTI CSCL 21F

Radiator configurations were evaluated in terms of the additional structure required to survive the launch environments imposed by the Tital 2C/7 launch vehicles. The conical radiator was preferred as it provides the maximum initial mass in earth orbit and needs the minimum structural addition relative to a spacecraft nominally optimized for thermal performance. This configuration, to be integrated with the spacecraft and launched in the upright position, requires the minimum parasitic launch support structure of about 4.3 pounds/kWe of gross unconditioned power (GUP) for the 300 kWe GUP in-core thermionic reactor power plants. Since 240 kWe conditioned power is required for the thruster subsystem, this weight penalty may also be expressed as about 5.4 pounds/kWe of net power plant. It is recommended that the standard launch shroud be eliminated and the radiator used as the primary shroud, with a special shroud designed to cover the reactor during launch. M.G.J.

N70-12180# National Lead Co. of Ohio, Cincinnati.
LOT CONTROL IN THE PRODUCTION OF URANIUM FUEL CORES
P. N. Mc Creary 17 Feb. 1969 8 p Presented at 23rd Ann. Tech. Conf. of the Am. Soc. for Quality Control, Los Angeles, 5-7 May 1969
(Contract AT(30-1)-1156)
(NLCO-1037; CONF-690524-1) Avail: CFSTI

Development of a quality assurance program from an inspection-oriented procedure to a control-oriented records system compatible with EDP is described. Punch cards are used to code each plant operation from U refining to machining of U rods into cores. The system is so arranged that with the aid of an intercom to each station, each step can be certified. NSA

N70-12223*# United Aircraft Corp., East Hartford, Conn. Research Labs.
STUDIES OF NUCLEAR LIGHT BULB START-UP CONDITIONS AND ENGINE DYNAMICS
Thomas S. Latham, Harold E. Bauer, and Richard J. Rodgers Sep. 1969 112 p refs
(Contract NASw-847)
(NASA-CR-107046; H-910375-4) Avail: CFSTI CSCL 21F

Finite-difference approximations to the time-dependent thermal, fluid dynamics and neutron kinetics equations were used to describe the operating characteristics of the engine. These equations were programmed on a UNIVAC 1108 digital computer to construct a dynamic simulation for predicting the response of the engine to selected perturbations occurring at the nominal full-power operating condition. A preliminary transient analysis was performed using the model, which simulates an uncontrolled engine, to determine the basic stability characteristics and to identify the parameters which would provide the most effective control mechanisms. Responses to perturbations in the uncontrolled system can be characterized by either steady-state or damped oscillations with a characteristic frequency of about 1 Hz. It was concluded that control of the engine could be achieved primarily by control of fuel injection rate. Author

N70-12225*# United Aircraft Corp., East Hartford, Conn. Research Labs.
THEORETICAL INVESTIGATION OF THE RADIANT

EMISSION SPECTRUM FROM THE FUEL REGION OF A NUCLEAR LIGHT BULB ENGINE
N. L. Krascella Oct. 1969 80 p refs
(Contract NASw-847)
(NASA-CR-107049; H-910092-12) Avail: CFSTI CSCL 21F

A theoretical investigation was conducted to determine the spectral emission characteristics of the fuel region of a nuclear light bulb engine and hence, the spectral radiative flux incident upon the transparent containment walls or upon the reflective end walls of such an engine. The analysis was performed for a specified engine configuration and for a specific nuclear fuel partial pressure distribution. Estimates of the spectral radiative flux emanating from the nuclear fuel region were made for a total radiated flux of 24,300 Btu/sq ft-sec, which corresponds to an effective black-body radiating temperature of 15,000 R (8333 K). Six cases were considered in which the effects of changes in the heavy-atom absorption coefficient model parameters, the addition of a seeding gas, and changes in end-wall reflectivities on the spectral radiative flux emitted from the nuclear fuel region were examined. Three cases involved parametric variations of the heavy-atom model in either the fuel species ionization potentials or in the oscillator strength distribution functions describing line transitions. In the fourth case, the effect of hydrogen as a seed gas on the emitted spectral radiative flux was studied. The effect on the emitted flux of a uniform end-wall spectral reflectivity of 0.5 was examined in the fifth case; similar calculations were made in the sixth case using the spectral reflectivity of aluminum. Author

N70-12229*# United Aircraft Corp., East Hartford, Conn. Research Labs.
EXPERIMENTAL INVESTIGATIONS TO SIMULATE THE THERMAL ENVIRONMENT, TRANSPARENT WALLS, AND PROPELLANT HEATING IN A NUCLEAR LIGHT BULB ENGINE
Ward C. Roman, John F. Klein, and Paul G. Vogt Sep. 1969 123 p refs
(Contract NASw-847)
(NASA-CR-107048; H-910091-19) Avail: CFSTI CSCL 21F

Experiments were conducted to develop an intense radiant energy source capable of producing radiant energy fluxes within the range expected in nuclear light bulb engines. Concurrently, small-scale internally cooled fused silica models similar to the transparent walls proposed for the engine were developed and tested. Experiments to demonstrate heating of a seeded simulated propellant by thermal radiation passing through the transparent wall were also initiated. Author

N70-12234*# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF GASEOUS NUCLEAR ROCKET TECHNOLOGY
G. H. Mc Lafferty ed. 30 Jun. 1969 56 p refs
(Contract NASw-847)
(NASA-CR-107045; H-910093-44; QPR-23) Avail: CFSTI CSCL 21F

The investigation of gaseous nuclear rocket technology covers work in the following technical areas: experimental investigations of vortex flow, primarily in an r-f heated vortex, to obtain information for application to a nuclear light bulb reactor; studies of coaxial flows; studies of the radiant heat transfer spectrum emitted from the fuel region of a nuclear light bulb reactor; studies of radiation effects on the transmission characteristics of transparent materials mounted in the Langley Dynamitron electron accelerator and in a conventional continuous reactor; and studies of the characteristics of full-scale engines and of models which might be tested in the Pewee test reactor. During the current report period, the maximum power deposited in a gas discharge by the r-f heater was increased from 130 to 215 kw. At this higher power level the power radiated through the peripheral wall was 156 kw, the corresponding radiating flux based on the discharge surface area was 36.7 kw/sq in, and the corresponding equivalent black-body radiating temperature was 10,200 R. Author

N70-12258# European Space Vehicle Launcher Development Organization, Paris (France).
NUCLEAR REACTORS FOR LOW THRUST PROPULSION OF SPACE VEHICLES [PROPULSION D'ENGINS SPATIAUX AU MOYEN D'UN REACTEUR NUCLEAIRE DE FAIBLE PUISSANCE]
P. Blanc and J. P. Contzen Sep. 1969 17 p In FRENCH
Presented at the 20th Congr. de la Fédération Intern. d'Astronautique, Buenos Aires, Oct. 1969
(ELDO-Publ-21) Avail: CFSTI

The possible use of nuclear propulsion for an ELDO Europa 3 launch vehicle upper stage is considered. Among possible solutions, a fast nuclear reactor weighing about 300 kg and furnishing 5–10 megawatts power was chosen. The nuclear fuel consists of a porous bed of spherical pellets through which the hydrogen flows radially attaining a high temperature. The hydrogen is then collected and expanded through a plug-nozzle furnishing a thrust which, in the conditions of the mission planned i.e. escape to a synchronous orbit, allows performances of about 1 ton, more than doubling the performance of a classical upper stage on the same launcher. Control rods in the core of the reactor allow control of the impulse and restart of the engine, thus allowing the choice of the two-impulse transfer solution. Technological problems of heat transfer, compatibility of high-temperature hydrogen with core materials under irradiation, porous interface fluid dynamics and safety aspects are also being studied. Author (ESRO)

N70-12300# Bettis Atomic Power Lab., Pittsburgh, Pa.
SURFACE DIFFUSION MEASUREMENTS IN THORIUM DIOXIDE, URANIUM DIOXIDE AND THORIUM DIOXIDE-URANIUM DIOXIDE (LWBR DEVELOPMENT PROGRAM)
R. M. Berman Jul. 1969 37 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-843) Avail: CFSTI

Diffusion in UO2 and ThO2 – UO2 mixtures were determined after heat treatments at 1510 to 2500 C by use of interference microscope. Photomicrographs were made of several different fields on each sample surface, and approximately 50 groove width measurements were made on these photographs for surface diffusion coefficient determination. An analysis of results is included. NSA

N70-12301# Bettis Atomic Power Lab., Pittsburgh, Pa.
JITER: A FORTRAN 4 PROGRAM FOR THE COMPUTATION FROM ONE DIMENSIONAL MODAL KINETICS MODELS OF STATISTICAL PARAMETERS MEASURED IN REACTOR
M. Natelson and D. R. Harris Jun. 1969 30 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-877) Avail: CFSTI

JITER is a FORTRAN-IV program which computes statistical parameters measured in reactor fluctuation experiments. These are the dispersion parameter, the modified coefficient of correlation, the frequency dependent part of the power spectral density, and the cross power spectral density. The computation is done as an expansion in the decaying modes of one-dimensional, few-group kinetics models. Author (NSA)

N70-12302# Oak Ridge National Lab., Tenn.
SHEAR-LEACH PROCESS: SEMICONTINUOUS AND BATCH LEACHING OF SHEARED UNIRRADIATED STAINLESS STEEL CLAD AND ZIRCALON UO2 AND UO2-Th-02
B. C. Finney, B. A. Hannaford, G. A. West, and C. D. Watson Jul. 1969 68 p refs
(Contract W-7405-eng-26)

(ORNL-3984) Avail: CFSTI

The Shear – Leach Process, basically a mechanical head-end process for recovery of fissile and fertile fuel values from discharged power reactor fuel elements, was developed as an alternative to exclusively aqueous methods such as the Darex, Zirflex, and Sulfex Processes. These aqueous processes involve dissolution of both the core and the cladding by use of strong acids such as aqua-regia, hydrofluoric acid, and sulfuric acid; therefore, exotic construction materials excelling the stainless steels are required to minimize corrosion of process and storage equipment. In the Shear – Leach Process, the fuel rods are ruptured by shearing, thus exposing the core material and permitting its preferential leaching with nitric acid; therefore, stainless steel can be used as the material of construction for piping and processing vessels. Since the cladding is not appreciably dissolved during the leaching procedure, it can be stored as a solid radioactive waste at approximately 5%, or less, of the cost of storing its liquid counterpart that results from the Darex or Sulfex Processes. Author (NSA)

N70-12322*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COLD-FLOW STARTUP TEST SUMMARY OF A FULL-SCALE NUCLEAR ROCKET ENGINE USING A RADIAL TURBOPUMP

Edward J. Petrik and John E. Reardon Washington Dec. 1969 42 p refs

(NASA-TM-X-1917) Avail: CFSTI CSCL 21F

Results are presented from an unfueled nuclear rocket simulator test conducted to determine if enough heat energy from the engine components is available to the turbine to start pumping propellant. The investigation was conducted with the pump at ambient and liquid-hydrogen temperatures and at tank pressures of 25 and 35 psia (17.2 and 24.1 N/sq cm) for both pump conditions. Data show a flow surge existed several seconds after power was applied to the turbine. Analysis indicates the flow surge experienced can be minimized either by flushing the system prior to applying power to the turbine or by programmed throttling at the pump discharge. Author

N70-12330# Zentralinstitut fuer Kernforschung, Rossendorf Bei Dresden (East Germany).

TEN YEARS RFR-FIVE YEARS RRR: A BACKWARD GLANCE AT THE WORK ON THE ROSSENDORF RESEARCH REACTOR [ZEHN JAHRE RFE-5 JAHRE RRR: EIN BUCKBLICK AUF DIE ARBEITEN AN DEN ROSSENDORFER FORSCHUNGSREAKTOREN]

E. Adam and J. Klebau Dec. 1967 74 p refs In GERMAN; ENGLISH summary

(ZFK-132) Avail: AEC Depository Libraries

A detailed summary of the 10 years operation of the Rossendorf research reactor is given; the reactor is described briefly. Use of the reactor as a reactor physics research tool is summarized. Nuclear physics work at the reactor is discussed; radiation effects studies on desne substances are summarized. Neutron diffraction work at the reactor is described; some results are given. Neutron activation analysis and isotope production are discussed. The Rossendorf zoned reactor is described; an operations history is given. Author (NSA)

N70-12338# Technische Hochschule, Darmstadt (West Germany). Fakulaet Fuer Maschinenbau.

ON THE TURBULENT VELOCITY DISTRIBUTION AND WALL FRICTION IN FLOW CHANNELS WITH DIFFERENT CROSS SECTIONS [UEBER DIE TURBULENTE GESCHWINDIGKEITSVERTEILUNG UND WANDREIBUNG IN STROEMUNGSKANAELEN VERSCHIEDENER QUERSCHNITTE]

Walter Eifler (Ph.D. Thesis) 9 Apr. 1968 208 p refs In GERMAN

Avail: CFSTI

In order to guarantee a sufficiently good heat transfer between nuclear fuel elements arranged in a circular tube, an exact treatment of the turbulent flow in the ring slot between the tube wall and the fuel elements is necessary. The velocity distribution and skin friction in concentric ring slots and nonconcentric slots and around a cluster of bars immersed in a parallel flow are calculated and appropriate experiments are described. Using a similitude hypothesis and a new relation for the apparent kinematic viscosity, numerical data is obtained, which is represented by diagrams. ESRO

N70-12347# Krupp (Fried.) G.m.b.H., Essen (West Germany). Zentralinst. für Forschung und Entwicklung.

REPROCESSING OF IRRADIATED THORIUM-CONTAINING FUEL ELEMENTS [AUFARBEITUNG BESTRAHLTER THORIUMHALTIGER KERNBRENNSTOFFE]

J. Hartwig and K. H. Ulrich *In its* Krupp Tech. Inform. Res. Rept., Vol. 27, No. 1 May 1969 p 27-38 refs In GERMAN; ENGLISH summary Presented at the Deut. Atomforum Meeting on Reactors, Frankfurt 15 Apr. 1969 Sponsored by Bundesmin. für Wiss. Forsch. (See N70-12343 02-34)

Avail: CFSTI

Coated particles from the THTR reactor, or from breeders in general, are reprocessed in a pilot plant to remove isotopes with a high neutron capture cross section. The fuel elements are heated to 3000°C in order to destroy the graphite and silicon dioxide coatings, and are then treated with chlorine at elevated temperatures. Any mechanical processing can thus be avoided. Chlorination and chloride extraction are carried out in separate steps, and a pilot plant is being developed which permits continuous operation. Author (ESRO)

N70-12350# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Dept.

FAST BREEDER REACTOR STATIC PHYSICS METHODS DEVELOPMENT AND ANALYSIS PROJECT Quarterly Technical Report, Jan. – Mar. 1969

J. M. Tilford and A. Z. Livolsi Jun. 1969 29 p

(Contract AT(30-1)-3867; FARED Proj.)

(BAW-3867-8) Avail: CFSTI

The testing of versions of the MC2 computer program is described. Running times for the various versions are compared. Progress in the development of design oriented, one dimensional criticality and depletion code FARED is presented. Corrections for the DAMMET and ETOE programs are included. Author (NSA)

N70-12367*# General Electric Co., Philadelphia, Pa. Missiles and Space Div.

A DESIGN STUDY FOR A MAGNETOHYDRODYNAMIC POWER SYSTEM FOR A NUCLEAR ELECTRIC PROPELLED UNMANNED SPACECRAFT Quarterly Progress Report, 26 May – 25 Sep. 1969

Sep. 1969 192 p refs Prepared for JPL

(Contracts NAS7-100; JPL-952415)

(NASA-CR-106995; GESP-7017; QPR-1) Avail: CFSTI CSCL 21F

This report discusses the progress made in the first quarter of a one-year design study of nuclear-electric propelled unmanned spacecraft using a magnetohydrodynamic (MHD) power system. Included as appendices is the analytical treatment of the MHD system upon which the spacecraft analysis is based. The study guidelines and approach are defined here, and the characteristics of one launch vehicle, the thruster subsystem, and the payload and communications system are presented. The MHD power conversion

system is described and methods used to calculate MHD system parameters are discussed. Included are the initial estimation of baseline (300 kWe) system design parameters and a discussion of the arrangement and structural arguments used to select system configurstion. The system startup technique is identified, and the nuclear reactor and primary radiator characterization are presented. Author

N70-12380# Battelle-Northwest, Richland, Wash. Metallurgy and Ceramics Dept.
COMPATIBILITY OF BOTH MIXED URANIUM-PLUTONIUM OXIDES AND NITRIDES WITH SODIUM AND 304 STAINLESS STEEL
F. M. Smith 30 May 1969 18 p refs
(Contract AT(45-1)-1830)
(BNWL-1101) Avail: CFSTI

Out-of-reactor experiments to determine the compatibility of mixed uranium – plutonium nitrides (UN – 20 wt % PuN) and hypostoichiometric mixed oxides (UO2-25 wt % PuO2), both helium- and sodium-bonded, to Type 304-stainless steel cladding have been performed. Capsules were heated for periods as long as 5000 hours at temperatures of 650 and 1000 C. No reactions or corrosion layers were observed on adjacent fuel-clad surfaces in cases of both oxide and nitride fuels under the time-temperature conditions investigated. Author (NSA)

N70-12417# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM, JUNE 1969 Progress Report
29 July 1969 136 p refs
(Contract W-31-109-eng-38)
(ANL-7581) Avail: CFSTI

Highlights of project activities are summarized for the month of June 1969. Fuel and components development programs for the LMFBR are described. LMFBR physics measurements and ZPR-3, ZPR-6, ZPR-9, and ZPPR operations during June are reviewed. Research and development programs in the EBR-2 are described. Nuclear safety studies, including TREAT operations and chemical separation activities are discussed. NSA

N70-12421# Western New York Nuclear Research Center, Inc., Buffalo.
DEVELOPMENT OF A RADIOACTIVE PEBBLE BED CHEMICAL REACTOR SYSTEM, PHASE 2
J. Y. Yang, H. T. Cullinan, and C. C. Thomas, Jr. Washington AEC 14 Feb. 1969 64 p refs
(Contract AT(30-1)-3864)
(NYO-3864-1) Avail: CFSTI

Detailed information regarding the reaction kinetics for the radiochemical production of benzotrichloride (alpha, alpha,alpha-trichlorotoluene) by the side-chain chlorination of toluene was obtained. At reaction temperatures greater than 80 C and pressures near one atmosphere, the rate of side-chain chlorination of toluene was found to be insensitive to limited temperature changes, but to show a square root dependence on radiation intensity and first order dependence with respect to the organic reactant concentration. With the exception of a deviation in the region of incipient fluidization, the ratio of fluidized bed height to static bed height was found to be linearly dependent on the Reynold's number in a log-log plot, and the bed porosity was determined. The point source equation was used to establish the energy distribution from a Sr-90 – y-90 beta source, and an axial dispersed plug flow equation was used to incorporate both the kinetic and the fluidization factors. Based on an overall G-value of 100,000, the reactor operating parameters required for given production rates were determined. NSA

N70-12423# Oak Ridge National Lab., Tenn.
PHYSICS, THERMAL HYDRAULIC, AND FUEL CYCLE COST ANALYSES OF A METALLIC URANIUM DIRECT REPLACEMENT FOR PWR'S
F. G. Welfare and J. E. Jones 11 Jul. 1969 40 p refs
(ORNL-TM-2493) Avail: CFSTI

The Diablo Canyon pressurized water reactor is analyzed with the oxide fuel replaced by annular metal pins. Thermal-hydraulic, physics, and fuel-cycle economics analyses are presented. The results show possible savings of up to .3 mills per kilowatt hour electric in fuel cycle costs. The possible effects of uncertainties in physics results, physics procedures, and fuel element performance are considered. The effect of these uncertainties may be to reduce the saving in fuel cycle cost to less than .1 mill per kilowatt hour electric. Perhaps the most significant result is that the metal fueled systems have the potential for shaprly reducing the separative work and ore requirements for an industry of pressurized water reactors. Author (NSA)

N70-12432# Atomic Power Development Associates, Inc., Detroit, Mich.
COMPILATION OF CURRENT TECHNICAL EXPERIENCE AT ENRICO FERMI ATOMIC POWER PLANT, MARCH 1969
R. E. Mueller Jan. 1969 32 p ref Prepared with the cooperation of Power Reactor Develop. Co. and Detroit Edison Co.
(Contract AT(11-1)-865)
(APDA-CFE-31) Avail: CFSTI

The refilling of the primary sodium system is described. Fuel transfer operations are tabulated. Difficulties encountered in the attempted transfer of a safety rod are described. Cover gas activities and analyses are tabulated. Details of the malfunction detection system are given. Repair of the steam cleaning chamber gripper is described. (NSA)

N70-12452# Skoda Works, Pilsen (Czechoslovakia). Nuclear Power Plant Div.
SOME ASPECTS OF ROD CLUSTER TYPE FUEL ASSEMBLIES OPERATION AND HOT CHANNEL FACTOR CALCULATIONS
V. Krett, J. Vicek, and P. Weber May 1969 35 p refs
(ZJE-44) Avail: AEC Depository Libraries

Calculations of the hot channel factor for heavy water gas cooled reactor fuel rods of the Bohunice Power Reactor Unit I are described. Two methods of calculation are discussed: the statistical method and the cumulative one. The complete mathematical procedure of the statistical evaluation is derived. On the basis of experimental investigations the evaluation of some subfactors is given. As a result of calculation the maximum surfa8e temperature for both methods is obtained. From the comparison of these calculations a difference of 18.2% is evident. The proposed method is generally applicable to all types of reactors. Author (NSA)

N70-12464# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, FEBRUARY 1969
25 Mar. 1969 129 p refs
(Contract W-31-109-eng-38)
(ANL-7553) Avail: CFSTI

Highlights of project activities are summarized for the month of February 1969. Fuel and components development program s for the LMFBR are described. Operations for the ZPR-3 and ZPPR during February are described. Research and development programs in the EBR-2 are reviewed. Nuclear safety studies, including TREAT operations, and chemical separation activities are discussed. NSA

N70-12485# Atomic Power Development Associates, Inc., Detroit, Mich.

COMPILATION OF CURRENT TECHNICAL EXPERIENCE AT ENRICO FERMI ATOMIC POWER PLANT, FEBRUARY 1969

R. E. Mueller Jun. 1969 47 p refs Prepared with the cooperation of Power Reactor Develop. Co. and Detroit Edison Co.
(Contract AT(11-1)-865)
(APDA-CFE-30) Avail: CFSTI

The restoration of the primary system for sodium refill is described; completion of lower plenum vacuuming, plenum inspection, and patching of the 14-inch line penetration are summarized. Mockup tests of the holddown mechanism inspection tool are discussed; results are outlined. Returning the transfer tank plugging indicator to service is summarized. Cover gas activity is tabulated for each sampling. Water manifold cover gasket replacements, sodium refill, and leak testing of the steam generators are discussed. Replacement of waste gas lines is described. The failure of a safety rod to detach from a steam cleaning chamber gripper is summarized. The new auxiliary fuel storage facility and fuel transfer facility which are being constructed inside the reactor building are described. NSA

N70-12488# Oak Ridge National Lab., Tenn. Chemical Technology Div.

THORIUM FUEL CYCLE DEVELOPMENT FOR 1967 AND 1968 Progress Report

R. G. Wymer, comp., A. L. Lotts, comp., and Sigfred Peterson ed. Aug. 1969 169 p refs
(Contract W-7405-eng-26)
(ONRL-4429) Avail: CFSTI

Progress is reported under the following topics: process demonstration and U-233 distribution, thorium–uranium recycle facility, sol-gel process development, fueled-graphite fabrication development, irradiation of coated-particle fuels, bulk oxide process development, characterization of oxide fuels, irradiation of bulk oxide fuels, and advanced studies. NSA

N70-12510# Argonne National Lab., Ill.

REACTOR DEVELOPMENT PROGRAM, JULY 1969 Progress Report

25 Aug. 1969 127 p refs
(Contract W-31-109-eng-38)
(ANL-7595) Avail: CFSTI

Highlights of project activities are summarized for the month of July 1969. Fuel and components development programs for the LMFBR are described. LMFBR physics measurements and ZPR-3 and ZPPR operations during July are reviewed. Research and development programs in the EBR-2 are described. Nuclear safety studies; including TREAT operations, and chemical separation activities are discussed. NSA

N70-12514# Union Carbide Corp., Oak Ridge, Tenn. Gaseous Diffusion Plant.

SEPARATION OF KRYPTON FROM AIR BY MEANS OF A PERMSELECTIVE MEMBRANE

S. Blumkin [1969] 14 p refs Revised
(Contract W-7405-eng-26)
(K-OA-1552-Rev-1) Avail: CFSTI

It is estimated that a capital investment of $1,100,000 is required to build a cascade, which has the dimethyl silicon membrane as the separating element and which can deplete the krypton in a reactor containment vessel after an accidental release of fission product gases by a factor of 100 in one week, during which 50,000 scf of removed krypton and associated gases are collected for storage. If the depletion time is extended to a month, the cascade cost is reduced to $300,000. The effect of doubling the quantity of hot gas to be stored has a negligible effect on cascade cost. If all but about 5% of the oxygen in the containment vessel is removed by chemical or other means, before the containment vessel air is fed to the membrane cascade, the estimated capital cost is reduced slightly to about $1,000,000. Author (NSA)

N70-12535# Battelle-Northwest, Richland, Wash.

MATHEMATICAL MODEL FOR DETERMINATION OF THE FAILURE PROBABILITY OF REACTOR COMPONENTS

D. Knecht and H. Zeibig 1969 19 p refs Transl. into ENGLISH from Atomwirtschaft, (Dusseldorf), v. 14, no. 2, 1969 p 87–92
(BNWL-tr-29) Avail: CFSTI

A mathematical model for determination of the failure probability of mechanically and thermally loaded components and systems is developed. This is made possible by the introduction of failure mechanisms which are independent of each other and which form the base of experimentally determinable mathematical interrelationships. A relationship between the failure probability and the safety factors is determined. Using this relationship one is able to calculate the necessary safety factors with given failure probabilities for a determined service life. The model is applied to components made of 10 CrMoNiNb 9 10-steel which has been subjected to the failure mechanisms creep and fatigue. Author (NSA)

N70-12541# Atomics International, Canoga Park, Calif.

SCORE 2: AN INTERACTIVE NEUTRON EVALUATION SYSTEM

C. L. Dunford, R. F. Berland, R. S. Hubner, and R. J. Creasy 1 Mar. 1969 106 p refs
(Contract AT(04-3)-701)
(AI-AEC-12757; ENDF-126; IBM-320-3241) Avail: CFSTI

The ability to analyze and evaluate the increasing amount of new neutron cross-section information is a vital part of the effort to design economic nuclear reactors. By application of computer graphics techniques, one may supply the cross-section evaluator with the tools which are necessary. By permitting man-computer interaction through computer graphics, both the rapidity and equality of evaluations will be greatly increased. A brief description of a prototype system, SCORE, is described in this document. Methods tested during the development of this prototype evaluation system have widespread general applications as well. Author (NSA)

N70-12543# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.

THE IRRADIATION OF URANIA-PLUTONIA FUEL TO 125000 MWd/Te IN A THERMAL FLUX

B. F. Rubin and K. J. Perry Mar. 1969 44 p refs
(Contract AT(04-3)-189)
(GEAP-5761; Rept-5867-BRDO-51) Avail: CFSTI

Pins containing mixed oxide fuel in the stoichiometric and hypostoichiometric states were irradiated to 125,000 MWd/t in a thermal flux in order to compare their irradiation performance. No significant differences were observed in regards to microstructure, dimensional change and gas release. X-ray diffraction patterns of the highly burned up fuel showed the crystallinity was retained, and that differences in stoichiometry, as indicated by differences in unit cell size, persisted at high burnup. The cell sizes of both fuels were smaller than pre-irradiation value, probably due to the inclusion of zirconium and rare earth fission products within the lattice. Author (NSA)

N70-12559# General Electric Co., San Jose, Calif. Nuclear Fuels Dept.

POWER REACTOR HIGH PERFORMANCE UO2 PROGRAM Progress Report, 1 Oct. 1968–31 Mar. 1969

S. Y. Ogawa comp. Apr. 1969 71 p Sponsored in part by EURATOM
(Contract AT(04-3)-189)

(GEAP-5771; EURAEC-2112; Rept-5882-NFD-71; PR-9) Avail: CFSTI

The complete results of the hot-cell examinations performed on eight selected fuel rods, and of the thermal-hydraulic test performed on a 3 × 3, 9-rod mock-up of the 7 × 7 Advanced Performance Fuel assembly corners are presented. The performance of the fuel rods from the standpoint of operation with UO sub 2 incipient and moderate central melting was very satisfactory. The results show that the failures appear to be strictly from causes external to the fuel rod and, especially, not a direct result of the centermelt operation. The evidence, suggests a localized cladding overheating with the high heat flux, crud deposition and unique thermal-hydraulic conditions downstream of the lateral spacing dimples on the corner angle all contributing in some manner not yet completely understood. Author (NSA)

N70-12561# Arizona Univ., Tucson. Dept. of Nuclear Engineering.
NONLINEAR OSCILLATIONS AND STABILITY OF A NUCLEAR REACTOR WITH TWO REACTIVITY FEEDBACKS
Theodore Reinold Schmidt, Jr. (Ph.D. Thesis) Jun. 1969 170 p refs
(Contract AT(04-3)-670)
(TID-25131) Avail: CFSTI

Fourier series expansions of the reactivity and power are used to search for limit cycles, successive approximations being generated by starting from the linear results. Higher approximations including feedback from higher harmonic frequencies are derived for not only the amplitude of the reactivity but also the amplitude of the power. The effective lifetime model and the prompt jump approximation with one group of delayed neutrons are the two models used for the neutron kinetics. The most general linear heat transfer equations for two regions are described and the linear transformation for decoupling the equations is derived. A special set of two-region heat transfer equations is discussed which describes the heat transfer in a nuclear reactor with in-core thermionic converters. Linear stability is examined by applying the Routh criterion and plotting stability boundaries in a parameter space of reactivity coefficients. The results obtained with the Fourier series method are compared with exact solutions obtained from analog and digital computations. Author (NSA)

N70-12567# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
NONDESTRUCTIVE TESTING OF ISOTOPE CONTAINMENT CAPSULES: SNAP-21 Final Report
R. W. Steffens Jun. 1969 45 p refs
(Contract AT(45-1)-1830)
(BNWL-1038) Avail: CFSTI

Because of the toxic and radioactive core material contained in the SNAP-21 isotope capsules, it is imperative that the container integrity be assured through a reliable quality control program. Remotely implementable ultrasonic weld inspection techniques and equipment were developed to provide nondestructive test quality assurance for the SNAP-21 closure welds. The SNAP-21 weld inspection test, when implemented with the UT-40 ultrasonic test station, automatically detects weld anomalies such as porosity, laminar voids, and unfused joint interfaces. The ultrasonic anomaly indications are recorded with an X-Y mapping technique which displays circumferential and axial anomaly locations in addition to anomaly axial length. Alignment of the ultrasonic beam up to 3 deg from normal in the axial plane and signal wave shaping techniques facilitate weld inspection when abnormal weld characteristics are encountered. The successful remote establishment of the four closure welds' integrity on two fueled SNAP-21 capsules provided final test certification. Author (NSA)

N70-12570# United Kingdom Atomic Energy Authority, Risley (England). Production Group.
POWER REACTOR FUEL SUPPLIES AND SERVICE OF THE UKAEA
J. A. Waddams 1968 7 p
(CONF-681064-7) Avail: AEC Depository Libraries

The various components of the UKAEA fuel service and the facilities available are described. The mode of operation of the service in relation to a reactor in Germany is indicated. NSA

N70-12637# Minnesota Mining and Mfg. Co., St. Paul, Minn. Electrical Products Group.
SNAP-23A PROGRAM, PHASE 1. THERMOELECTRIC CONVERTER DEVELOPMENT PROGRAM Quarterly Report, 1 Jan. - 31 Mar. 1969
30 Apr. 1969 163 p
(Contract AT(30-1)-3824)
(MMM-3824-34; QR-9) Avail: CFSTI

The design base criteria selected to control design selections and trade-offs for the prototype mockup converter (PMC-2) were established on the premise that PMC-2 would be integrated into a fueled prototype mockup system. Areas of design investigation were conducted on effects of ambient temperature increase on converter performance, effects of potential T/E degradation upon converter performance, and enclosure structure suitability to operational environment. The effects of ambient temperature increase and degradation analysis produced a change in converter operating temperature. NSA

N70-12638# California Univ., Livermore. Lawrence Radiation Lab.
CONTROLLED THERMONUCLEAR POWER
R. W. Werner, B. Myers, J. D. Lee, and P. B. Mohr 27 Jun. 1969 13 p refs Presented at 4th Intersoc. Energy Conversion Eng. Conf., Washington, D.C., 17-19 Sep. 1969 Submitted for publication Sponsored by AEC
(UCRL-71500; CONF-690905-1) Avail: CFSTI

A review is given of the elements of controlled thermonuclear power, the physics of containing a hot plasma, and the variety of proposed machines usable for a reactor. A reference design for a power-producing reactor is discussed which uses a lithium blanket surrounding the hot plasma to absorb energy and allow regeneration of the tritium fuel consumed in the basic reaction. A magnet surrounds the lithium blanket to provide a field for containing the plasma. The energy produced proceeds through a thermal conversion cycle, although there is the potential for direct electrical conversion. Author (NSA)

N70-12644# Gesellschaft fuer Kernforschung M.B.H., Karlsruhe (West Germany). Inst. fuer Angewandte Reaktorphysik.
CONSTRUCTION AND PERFORMANCE OF SNEAK REACTIVITY METER
H. Walze Mar. 1968 36 p refs Transl. from German report no. KFK-739 Sponsored by US/EURATOM
(EURFNR-519; EUR-3722; KFK-739) Avail: CFSTI

The RM described is a simple and sensitive reactor monitoring device which can be used to ascertain reactivity changes quickly. Its characteristic time constant is approx. 25 ms if output signal equalization is dispensed with a delay-free recording device is connected up. The remaining defects can be eliminated by using different C sub i condensers and a better multiplier. With these improvements, the RM would be a reliable reactivity measurement system as well as a monitoring device. Author (NSA)

N70-12661# Institutt for Atomenergi, Halden (Norway).
OBSERVATIONS OF FUEL PIN INTERNAL PRESSURE
M. Hurme Jun. 1969 37 p refs
(OECD Halden Reactor Proj.)
(HPR-110) Avail: AEC Depository Libraries

In-pile measurements of fuel pin gas pressure are performed

in Halden with a diaphragm-type pressure transducer. When the moderator is electrically heated from 80 deg C to 160 deg C, pressure peaks around 100 deg C have been observed in some newly loaded fuel assemblies, indicating moisture release. During the nuclear heating of the moderator from 160 deg C to 240 deg C a pressure increase has been observed which is significantly larger than that corresponding to the thermal expansion of the filler gas. After the first heating-up of the assembly, the pressure can decrease even at constant power level, indicating decomposition of water from moisture in the fuel. This process takes from some hours to two weeks. Power cycling accelerates both the water decomposition process and the gas release. When fuel is brought from full power to zero and up to full power again, no sudden increase of pressure or gas release has been observed. Author (NSA)

N70-12665# Gulf General Atomic, San Diego, Calif.
HTGR BASE PROGRAM Quarterly Progress Report, 1 Mar. – 31 May 1968
28 Jun. 1968 129 p refs
(Contract AT(04-3)-167)
(GA-8662) Avail: CFSTI

Research and development tasks related to the preliminary design and exploratory development of a 1000-Mw(e), gas-cooled, nuclear power reactor are reported. Studies include: reactor engineering development, analytical methods, fission-product mechanisms, recycle fuel studies, experimental physics, physics and fuel management, advanced coated particle fuels, and graphite research. M.H.E.

N70-12666# Gulf General Atomic, San Diego, Calif.
HTGR BASE PROGRAM Quarterly Progress Report, 1 Sep. – 30 Nov. 1968
30 Dec. 1968 63 p refs
(Contract AT(04-3)-167)
(GA-9090) Avail: CFSTI

Research and development tasks related to the design and exploratory development of a 1000-Mw(e), gas-cooled, nuclear power reactor are reported. Studies include: reactor engineering development, analytical methods, fission-product mechanisms, recycle fuel studies, experimental physics, physics and fuel management, advanced coated particle fuels, and graphite research. M.H.E.

N70-12667# Gulf General Atomic, San Diego, Calif.
HTGR BASE PROGRAM Quarterly Progress Report, 1 Mar. – 30 May 1969
27 Jun. 1969 292 p refs
(Contract AT(04-3)-167)
(GA-9372) Avail: CFSTI

Research and development tasks related to the design and exploratory development of a 1000-Mw(e), gas-cooled, nuclear power reactor are described. Studies include: reactor engineering development, analytical methods, fission-product mechanisms, recycle fuel studies, experimental physics, physics and fuel management, advanced coated particle fuels, and graphite research. M.H.E.

N70-12700# RAND Corp., Santa Monica, Calif.
TRANSPORT CALCULATIONS PERTINENT TO SATELLITE DETECTION OF X RAY FROM NEAR EARTH NUCLEAR EXPLOSIONS
Harmon W. Hubbard Jun. 1969 41 p refs
(AD-692699; RM-6033) Avail: CFSTI CSCL 18/3

The work is part of a study of detection of nuclear explosions by satellite instruments. To examine the effect of scattering of X rays by the atmosphere before detection at a satellite, Monte Carlo calculations have been made for point monoenergetic sources of 10 Kev, 30 Kev and 100 Kev at altitudes from 30 km to 150 km. Results are given for the ratio of scattered to vacuum energy deposition as a function of satellite observation angle, and for the energy spectra observed at fixed angles of observation. Author (TAB)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N70-11441# Aerospace Research Labs., Wright-Patterson AFB, Ohio. General Physics Research Lab.
CONSTRAINTS IN ELECTRODYNAMICS AND QUANTIZATION OF THE ELECTROMAGNETIC FIELD WITHOUT CHARGES
Moshe Carmeli 1969 18 p refs
(AD-693215) Avail: CFSTI CSCL 20/10

The degrees of freedom of the electromagnetic field is discussed. It is pointed out that a single complex function, which satisfies a two-dimensional wave equation, can be defined to describe the dynamics of the Maxwell field. The canonical quantization procedure is then applied to quantize this wave equation for the case without charges. As a result, the electromagnetic field is effectively quantized, with the familiar problem of constraints becoming redundant. Author (TAB)

N70-11450# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div.
PRESSURE-COMPENSATING SYSTEM FOR GAS-FILLED TRANSDUCERS
G. D. Hugus, III 25 Sep. 1969 17 p refs
(AD-693451; NRL-6981) Avail: CFSTI CSCL 20/1

A self-contained pressure-compensating system has been developed for use with the USRD type J11 moving-coil transducer at ocean depths to 600 ft. This system conserves compensating gas for uninterrupted use over a period of 8 hours or more. It responds to changes in depth by holding the pressure differential on the diaphragm of the transducer to less than 0.7 psi with negligible effect on the acoustic response. Author (TAB)

N70-11488# RAND Corp., Santa Monica, Calif.
PROPAGATION OF SOUND AS AFFECTED BY WIND AND TEMPERATURE GRADIENTS
R. H. Frick Jul. 1969 93 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-693090; RM-5830-ARPA) Avail: CFSTI CSCL 17/1

An analysis of the effect of atmospheric conditions on the acoustic detection of low-flying aircraft. For a given position at ground level, the problem is to determine the sound intensity resulting from a sound source of known acoustical power at specified altitude, range, and direction relative to the observer. A stratified atmosphere is assumed in which the temperature, wind velocity, and humidity are dependent on the altitude only. Specification of a refraction law for the sound ray emanating from the elevated source is followed by development of a three-dimensional ray-tracing program to determine the ground-level sound intensity due to a source at an altitude of 500 ft radiating 100 kW (134 HP) of acoustical power. The analysis reveals that the detection range of an elevated source is extremely sensitive to azimuth of propagation as well as to source altitude, power, and frequency. Author (TAB)

N70-11491# Woods Hole Oceanographic Institution, Mass.
A DATA EVALUATION OF A PREDICTION PROGRAM FOR SOUND TRANSMISSION IN A SURFACE LAYER
Eli Joel Katz Jun. 1969 28 p refs
(Contract Nonr-4029(00))

(AD-693505) Avail: CFSTI CSCL 20/1

Acoustic data from the files of the Woods Hole Oceanographic Institution are presented in a form which permits direct comparison with a surface-layer, sound transmission, prediction program operated by the Fleet Numerical Weather Central, Monterey. A total of nine exercises, typically providing data at several ranges and several shots at each range, are compared. Transmission ranges vary from a minimum of one to a maximum of nineteen kiloyards. Frequencies span the range 0.1 - 10 kHz. Author (TAB)

N70-11500# Cambridge Acoustical Associates, Inc., Mass.
UNDERWATER SHOCKWAVE FOCUSING AT CAUSTICS: COMPARISON OF THEORY AND EXPERIMENT Final Report, 1 Jul. 1968 - 31 Aug. 1969
David A. Sachs 31 Aug. 1969 40 p refs
(Contract N00014-66-C-0110)
(AD-693313; U-322-188) Avail: CFSTI CSCL 20/1

A theory of shockwave focusing is employed in an attempt to predict the extent of focusing of explosive pulses at caustics as observed experimentally. Assuming a viscous medium and a physically reasonable model for the explosive pulse, an order of magnitude comparison with experiment is obtained. The omission of viscosity from the mathematical model leads to unacceptably large amplification at the caustic. Author (TAB)

N70-11508*# Techtran Corp., Glen Burnie, Md.
REPORT ON RECENT RESEARCH ON NONLINEAR OSCILLATIONS [EXPOSE DES RECHERCHES RECENTES SUR LES OSCILLATIONS NON LINEAIRES]
L. Mandelstam et al Washington NASA Nov. 1969 60 p refs Transl. into ENGLISH from Tech. Phys. of the USSR (Leningrad), v. 2, 1935 p 81 - 384 Presented at Intern. Sci. Radio Union, London, 12 - 18 Sep. 1934
(Contract NASw-1695)
(NASA-TT-F-12678) Avail: CFSTI CSCL 20N

A short summary is presented of works performed recently at the Institute of Physics of the University of Moscow and several of the laboratories on the problem of nonlinear oscillators. The discussion is limited to systems with one degree of freedom, in the most essential aspects. Author

N70-11509# Rochester Univ., N.Y. Acoustical Physics Lab.
AN EXPERIMENTAL INVESTIGATION OF FINITE AMPLITUDE OSCILLATIONS IN A CLOSED TUBE AT RESONANCE Scientific Interim Report
Donald B. Cruikshank, Jr. 31 Sep. 1969 165 p refs
(Contracts F44620-69-C-0044; N00014-68-A-0091)
(AD-693635; AFOSR-69-1869-TR) Avail: CFSTI CSCL 20/1

An experimental study of the theoretical analysis given by W. Chester to predict the pressure waveforms generated by a piston in a closed acoustic resonance tube is described. Chesters waveform predictions are summarized. It is shown that a high piston displacement amplitude is required to establish an experimental condition consistent with the approximations of Chesters analysis. Comparisons between theory and experiment are made at the resonance frequency and at two frequencies bracketing resonance for three successively higher piston displacement amplitudes. Although better agreement is expected as the amplitude increases, this increasing agreement is observed only at the frequency above resonance, and not at the resonance frequency or below. However, good qualitative agreement between the shapes of experimental and theoretical waveforms is found at high piston displacement amplitude. The pressure response curve of the experimental system is shown to be asymmetric. On the basis of this experimental observation, a qualitative argument is presented to explain the disagreement between theory and experiment. It is concluded that Chesters theory is qualitatively good at high amplitudes but deficient in detail because it apparently does not account for the amplitude effect of the skewed response curve. Author (TAB)

N70-11561# IIT Research Inst., Chicago, Ill.
FIBER OPTICS WITH EXTENDED ULTRAVIOLET TRANSMISSION Triannual Report, 1 Jan. - 30 Apr. 1969
M. A. Ali, A. G. Pincus, and M. A. Schwartz Aug. 1969 82 p refs
(Contract DAAB07-67-C-0542)
(AD-693259; ECOM-0542-5) Avail: CFSTI CSCL 11/2

The objective of this contract is to conduct research and development leading to the fabrication of fiber-optic faceplates for cathode ray tubes with high transmission in the near and middle ultraviolet spectral regions. During this period, studies were primarily conducted to further improve the transmission properties of the optical glasses being developed and to gain a better understanding of the fundamental theories relating to uv absorption. Compositional studies included the use of acidity control and redox oxide additions. Processing studies included time, temperature, atmosphere, and stirring effects. Mass spectrographic analyses were conducted to determine impurities in selected glasses.
Author (TAB)

N70-11591*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
THE SCATTERING OF POLARIZED LIGHT BY POLYDISPERSE SYSTEMS OF IRREGULAR PARTICLES
Alfred C. Holland Washington Nov. 1969 24 p refs
(NASA-TN-D-5458; C-97) Avail: CFSTI CSCL 20F

The elements of the Mueller matrix for polydisperse systems of irregular, randomly oriented particles have been measured in absolute terms as a function of scattering angle for one wavelength. These results have been compared to the matrix elements that were calculated for assemblies of spherical particles that fit the same particle size distribution function and have the same (real) refractive index. Correlations between the measured and calculated matrix elements are discussed. Author

N70-11611# Goodyear Aerospace, Akron, Ohio.
RESEARCH IN THE DEVELOPMENT AND APPLICATION OF NONGLASS OPTICAL INFINITY DISPLAY TECHNIQUES FOR VISUAL SIMULATION Final Report, 1 Apr. 1967 - 15 Dec. 1968
James A. Horton, Robert M. Emerick, and James E. Mount Jul. 1969 73 p
(Contract F33615-67-C-1537)
(AD-693651; AFHRL-TR-69-2) Avail: CFSTI CSCL 20/6

Infinity display devices possess many desirable properties that enhance the training value of aircraft flight simulators. In the past, little has been done to apply reflective infinity display techniques to the problem of wide-angle visual simulation. This is primarily because glass mirrors were necessary to obtain the needed optical quality. These mirrors were heavy, fragile, expensive, and took a long time to manufacture. Additional support structures and control systems required by glass mirrors only added to the cost and complexity. Objectives of the nonglass infinity display research program were to study wide-angle display system concepts develop high-quality nonglass mirrors and fabrication techniques, build a prototype display system, and define cathode ray tube characteristics needed for the display. A prototype unit using nonglass mirrors was fabricated having a 120-degree horizontal field of view and a 45-degree vertical field. Author (TAB)

N70-11768*# Aztec School of Language, Inc., Maynard, Mass. Research Translation Div.
DIFFRACTION OF AN ELECTROMAGNETIC FIELD ON AN UNBOUNDED HOLLOW CYLINDER IN A CONDUCTING HALF-SPACE

G. G. Kozina et al *In its* Probl. of Wave Diffraction and Propagation, No. 7 Nov. 1969 p 118–129 refs (See N70-11751 02-07)
Avail: CFSTI CSCL 20C

A field diffracted on a hollow cylinder of infinite length in the lower conducting half space of a two-layered medium divided by a plane boundary, which is produced by vertical or horizontal magnetic dipoles in the lower half space is studied. It is found that a vertical magnetic dipole is more sensitive to all discontinuities than a horizontal one. Author

N70-11760*# Aztec School of Language, Inc., Maynard, Mass. Research Translation Div.
SOME FORMULAS FOR SHORT WAVE ASYMPTOTICS IN THE THREE-DIMENSIONAL PROBLEM OF DIFFRACTION ON SMOOTH CONVEX BODIES
D. Sh. Mogilevskiy *In its* Probl. of Wave Diffraction and Propagation, No. 7 Nov. 1969 p 139–150 refs (See N70-11751 02-07)
Avail: CFSTI CSCL 20N

Studies using the method of the parabolic equation are discussed. Combined formulas for these problems and the problems of light and shadow are given. Author

N70-11761*# Aztec School of Language, Inc., Maynard, Mass. Research Translation Div.
EFFECT OF A STEPLIKE DISCONTINUITY ON A FIELD IN A PLANE WAVEGUIDE
B. V. Nerinovskiy *In its* Probl. of Wave Diffraction and Propagation, no. 7 Nov. 1969 p 151–161 refs (See N70-11751 02-07)
Avail: CFSTI CSCL 20N

The effect of a steplike discontinuity in a plane unbounded waveguide with ideal walls is investigated. The problem is reduced to solutions to Maxwellian equations which satisfy definite boundary conditions, solved by the method of successive approximations, using the Schwarz algorithm. Author

N70-11765*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
PERTURBATION OF ELECTROMAGNETIC FIELDS BY MOVING BODIES
V. S. Gerasimov et al *In its* Probl. of Wave Diffraction and Propagation, No. 7 Nov. 1969 p 195–200 refs (See N70-11751 02-07)
Avail: CFSTI CSCL 20N

Calculations show that, if a body is extended into an ellipsoid with axis orthogonal to the field (electric or magnetic), maintaining a constant volume, then the distrubances it undergoes (in correspondence with the electric or magnetic field) decrease with an increase of this axis. Author

N70-11767*# Aztec School of Language, Inc., Maynard, Mass. Research Translation Div.
EXPERIMENTAL STUDY OF THE DIPOLE AND CURRENT MOMENTS OF LIGHTENING DISCHARGES. PART 1: METHODS OF STUDYING A DIPOLE MODEL OF EMISSION SOURCES
Yu. V. Shtennikov *In its* Probl. of Wave Diffraction and Propagation, No. 7 Nov. 1969 p 222–232 refs (See N70-11751 02-07)
Avail: CFSTI CSCL 20N

Two methods of studying the dipole and current moments are described. It is shown that the method of direct recording with the aid of filters has definite advantages, particularly for short-period signals. Author

N70-11780*# National Aeronautics and Space Administration, Washington, D.C.
PHYSICS OF AERODYNAMIC NOISE
A. V. Rimskiy-Korsakov, ed Nov. 1969 110 p refs Transl. into ENGLISH of the book "Fizika Aerodinamicheskikh Shumov" Moscow, Izd. AN SSSR, 1967
(NASA-TT-F-538) Avail: CFSTI CSCL 20A

CONTENTS:

1. A STUDY OF DISCRETE COMPONENTS OF THE NOISE SPECTRUM OF AN AXIAL COMPRESSOR D. V. Bazhenov et al p 1–11 refs (See N70-11781 02-23)

2. EFFECT OF THE DESIGN OF WALLS OF THE AIR INTAKE DUCT OF AN AXIAL COMPRESSOR ON THE PROPAGATION OF SOUND D. V. Bazhenov et al p 12–25 refs (See N70-11782 02-23)

3. EXPERIMENTAL STUDY OF THE EFFECT OF ROUGHNESS OF A SURFACE OF A BAR ON THE INTENSITY AND FREQUENCY OF VORTEX SOUND D. V. Bazhenov et al p 26–34 refs (See N70-11783 02-23)

4. PROPAGATION OF SOUND IN A CYLINDRICAL PIPE WITH STREAMLINED IMPEDANCE WALLS A. V. Rimskiy-Korsakov et al p 35–39 refs (See N70-11784 02-23)

5. EFFECT OF THE REACTION OF THE MEDIUM ON THE OPERATION OF A RADIATOR IN A WAVEGUIDE A. D. Lapin et al p 40–46 ref (See N70-11785 02-23)

6. RADIATION OF AN ELASTIC DISCONTINUOUS WALL IN A MOVING MEDIUM A. D. Lapin p 47–55 refs (See N70-11786 02-23)

7. PULSATIONS OF COLLIDING AXISYMMETRICAL JETS OF GASEOUS OXIDIZER AND PROPELLANT V. I. Kondrat'yev p 56–57 ref (See N70-11787 02-23)

8. FREQUENCY CHARACTERISTICS OF BAR-TYPE GAS-JET ACOUSTIC GENERATORS Yu. Ya. Borisov et al p 58–65 refs (See N70-11788 02-23)

9. THE SUPERSONIC AIR JET AS A SOURCE OF SOUND V. M. Mamin et al p 66–70 refs (See N70-11789 02-23)

10. THE FREQUENCY SPECTRUM OF THE NOISE OF A SUPERSONIC JET T. Kh. Sedel'nikov p 71–75 refs (See N70-11790 02-23)

11. THE DISCRETE COMPONENT OF THE FREQUENCY SPECTRUM OF THE NOISE OF A FREE SUPERSONIC JET T. Kh. Sedelinikov p 76–89 refs (See N70-11791 02-23)

12. THE DISPERSION EQUATION OF A PLANE EJECTOR L. I. Nazarova et al p 90–96 refs (See N70-11792 02-23)

13. THE DISPERSION EQUATIONS FOR MULTILAYER JETS AND FOR SEVERAL JETS T. Kh. Sedel'kikov p 97–102 refs (See N70-11793 02-23)

N70-11781*# National Aeronautics and Space Administration, Washington, D.C.
A STUDY OF DISCRETE COMPONENTS OF THE NOISE SPECTRUM OF AN AXIAL COMPRESSOR
D. V. Bazhenov et al *In its* Phy. of Aerodyn. Noise Nov. 1969 p 1–11 refs (See N70-11780 02-23)
Avail: CFSTI CSCL 20A

The article deals with the mechanism of formation of the discrete components of the noise spectrum at the intake of an axial compressor. It shows that the intensity of this noise is highly dependent on the blade ratio of the stationary and rotating blading. It shows that this noise can be reduced by changing the distance between the two types of blading as well as the blade angle. Author

N70-11782*# National Aeronautics and Space Administration, Washington, D.C.
EFFECT OF THE DESIGN OF WALLS OF THE AIR INTAKE DUCT OF AN AXIAL COMPRESSOR ON THE PROPAGATION OF SOUND
D. V. Bazhenov et al *In its* Phys. of Aerodyn. Noise Nov. 1969 p 12–25 refs (See N70-11780 02-23)
Avail: CFSTI CSCL 20A

Examined is a method for simulating, under laboratory

conditions, sound sources which have parameters close to those existing in axial turbocompressors with guide vanes. Thereupon the propagation of such sound over a coaxial waveguide with parameters close to those of a turbocompressor air intake duct is considered. The effect of resonators and active absorptive linings on the attenuation of sound propagating in the waveguide is also examined. Author

N70-11783*# National Aeronautics and Space Administration, Washington, D.C.
EXPERIMENTAL STUDY OF THE EFFECT OF ROUGHNESS OF A SURFACE OF A BAR ON THE INTENSITY AND FREQUENCY OF VORTEX SOUND
D. V. Bazhenov et al *In its* Phys. of Aerodyn. Noise Nov. 1969 p 26–34 refs (See N70-11780 02-23)
Avail: CFSTI CSCL 20A

The present article deals with the effect of different rough surfaces of a bar on the intensity and frequency of the vortex sound generated by it as it moves through air, and on its aerohydrodynamic head drag. Described are tests of smooth cylindrical bars, bars covered by brass mesh or a perforated brass tube, as well as grooved bars (bars were rotated in the "windmill" or "squirrel-cage" fashion). Author

N70-11784*# National Aeronautics and Space Administration, Washington, D.C.
PROPAGATION OF SOUND IN A CYLINDRICAL PIPE WITH STREAMLINED IMPEDANCE WALLS
A. V. Rimskiy-Korsakov et al *In its* Phy. of Aerodyn. Noise Nov. 1969 p 35–39 refs (See N70-11780 02-23)
Avail: CFSTI CSCL 20A

Proposed is extending the problem of sound propagation in a pipeline with impedance walls to the case of a moving medium with mth symmetry of the wave being excited. Author

N70-11785*# National Aeronautics and Space Administration, Washington, D.C.
EFFECT OF THE REACTION OF THE MEDIUM ON THE OPERATION OF A RADIATOR IN A WAVEGUIDE
A. D. Lapin et al *In its* Phys. of Aerodyn. Noise Nov. 1969 p 40–46 ref (See N70-11780 02-23)
Avail: CFSTI CSCL 20A

Presented are calculations of the radiation impedance and of the associated mass of a cylindrical radiator, situated in a waveguide with perfect reflecting boundaries. Author

N70-11786*# National Aeronautics and Space Administration, Washington, D.C.
RADIATION OF AN ELASTIC DISCONTINUOUS WALL IN A MOVING MEDIUM
A. D. Lapin *In its* Phys. of Aerodyn. Noise Nov. 1969 p 47–55 refs (See N70-11780 02-23)
Avail: CFSTI CSCL 20A

Considered is a sound field which is produced in a homogeneous flow of an ideal fluid by a discontinuous elastic wall, which executes induced vibrations under the effect of random forces. It is assumed that the properties of the wall vary periodically. The qualitative behavior of variations in the field characteristics as a function of variation of wall parameters, the motion of the medium and the properties of the statistical forces is clarified. Author

N70-11787*# National Aeronautics and Space Administration, Washington, D.C.
PULSATIONS OF COLLIDING AXISYMMETRICAL JETS OF GASEOUS OXIDIZER AND PROPELLANT
V. I. Kondrat'yev *In its* Phys. of Aerodyn. Noise Nov. 1969 p 56–57 ref (See N70-11780 02-23)
Avail: CFSTI CSCL 20A

Described are the pulsations of flames produced upon collisions between axisymmetrical jets of propane-butane and oxygen, and the sound formation attendant to it. Pictures obtained with a high-speed movie camera show the mode of the flame pulsations. Flame pulsation frequencies at different oxidizer and propellant speeds are also presented. Author

N70-11788*# National Aeronautics and Space Administration, Washington, D.C.
FREQUENCY CHARACTERISTICS OF BAR-TYPE GAS-JET ACOUSTIC GENERATORS
Yu. Ya. Borisov et al *In its* Phys. of Aerodyn. Noise Nov. 1969 p 58–65 refs (See N70-11780 02-23)
Avail: CFSTI CSCL 20A

Presented are results of an experimental study of the relationship between the internal structure of the jet and the frequency of sound vibrations produced by the generator and the geometric dimensions of some of its principal elements, i.e., the bar and jet diameter, resonator dimensions, etc. Author

N70-11789*# National Aeronautics and Space Administration, Washington, D.C.
THE SUPERSONIC AIR JET AS A SOURCE OF SOUND
V. M. Mamin et al *In its* Phys. of Aerodyn. Noise Nov. 1969 p 66–70 refs (See N70-11780 02-23)
Avail: CFSTI CSCL 20A

This article is devoted to the timely problem of experimental study of the noise of a supersonic air jet. Author

N70-11790*# National Aeronautics and Space Administration, Washington, D.C.
THE FREQUENCY SPECTRUM OF THE NOISE OF A SUPERSONIC JET
T. Kh. Sedel'nikov *In its* Phys. of Aerodyn. Noise Nov. 1969 p 71–75 refs (See N70-11780 02-23)
Avail: CFSTI CSCL 20A

Presented is a theoretical explanation of certain features of the noise spectrum of supersonic jets. It is shown that using linearized equations of the acoustics of a moving medium, it is possible to calculate the frequency of the maximum of the frequency spectrum of the noise of a hot supersonic jet. Author

N70-11791*# National Aeronautics and Space Administration, Washington, D.C.
THE DISCRETE COMPONENT OF THE FREQUENCY SPECTRUM OF THE NOISE OF A FREE SUPERSONIC JET
T. Kh. Sedel'nikov *In its* Phys. of Aerodyn. Noise Nov. 1969 p 76–89 refs (See N70-11780 02-23)
Avail: CFSTI CSCL 20A

Presented is a theoretical explanation of the discrete component of the frequency spectrum of the noise of a jet. The instability of pulsations of plane and axisymmetrical jets is analyzed to show the feasibility of predicting the formation of a discrete component in a jet's noise spectrum. Author

N70-11792*# National Aeronautics and Space Administration, Washington, D.C.
THE DISPERSION EQUATION OF A PLANE EJECTOR
L. I. Nazarova et al *In its* Phys. of Aerodyn. Noise Nov. 1969 p 90–96 refs (See N70-11780 02-23)
Avail: CFSTI CSCL 20A

Of great interest at present is the determination of the frequency spectrum of the noise of an annular jet, several jets, etc. The present article derives dispersion equations for determining the stability of the boundaries of multilayer jets and of several jets. Author

N70-11783*# National Aeronautics and Space Administration, Washington, D.C.
THE DISPERSION EQUATIONS FOR MULTILAYER JETS AND FOR SEVERAL JETS
T. Kh. Sedel'nikov *In its* Phys. of Aerodyn. Noise Nov. 1969 p 97–102 refs (See N70-11780 02-23)
Avail: CFSTI CSCL 20A

This article presents a theoretical study of the stability of the boundaries of a plane supersonic jet in a plane ejector. It also gives a theoretical explanation of some features of the noise spectrum of a jet discharged from a nozzle in the presence of an ejector. Author

N70-11969# Ceskoslovenska Akademie Ved, Rez.
OPTICAL CHARACTERISTICS OF A QUADRUPOLE LENS PAIR
P. Franc May 1969 11 p
(UJV-2177-A) Avail: CFSTI

Equations are presented to solve the problems of astigmatic image forming using a pair of quadrupole magnetic lenses. The method may also be used for a pair of electrostatic quadrupole lenses. NSA

N70-12120*# California Univ., La Jolla. Dept. of Applied Electrophysics.
THE APPLICATION OF SIGNAL DETECTION THEORY TO OPTICS Progress Report
Carl W. Helstrom 15 Mar. 1969 18 p refs
(Grant NGR-05-009-079)
(NASA-CR-106846) Avail: CFSTI CSCL 20F

In designing a quantum-limited optical system, an object emitting light with a Lorentz spectrum has a lower probability of detection than one with a rectangular spectrum, for equal false-alarm probabilities and equal average numbers of photons received from object and background. It is assumed that the light possesses first order spatial coherence over the entire aperture. A computer program was written to determine the optimum projection operators for making a decision with minimum average probability of error, the three coherent states of a simple harmonic oscillator being assigned equal prior probabilities. The distribution of photoelectric counts from incoherent light falling on a photosensitive surface during an interval of duration T is expressed in terms of the Fredholm determinant of an integral equation whose kernel is the temporal autocovariance function of the light. This Fredholm determinant has been calculated for light with a Lorentz spectrum. R.B.

N70-12141# Naval Research Lab., Washington, D.C. Physical Acoustics Branch.
SCATTERING OF ACOUSTIC PULSES BY A RIGID SPHERE IN A FLUID
A. J. Rudgers *In its* Rept. of NRL Progress Oct. 1969 p 1–14 refs (See N70-12140 02-34)
Avail: CFSTI

The scattered field, produced when a plane-wave pressure pulse is incident upon an ideally rigid sphere, is expressed in the terms of classical scattering theory. The resultant scattered pulse is determined at a number of field points, with a computer, by using an incident pulse of known spectral content. The time-varying forms of the scattered pulses, thus obtained by using the completely rigorous classical theory, display characteristics that may be interpreted in terms of circumferential or creeping waves propagating along the periphery of the sphere. The scattered pulse may be conceived as the superposition of a specularly reflected pulse, with a form similar to the incident pulse, and attenuating pulses that travel along the periphery of the sphere from the boundary of the geometrical shadow to the observation point. Author

N70-12142# Naval Research Lab., Washington, D.C.
PROBLEM NOTES
In its Rept. of NRL Progress Oct. 1969 p 15–31 refs (See N70-12140 02-34)
Avail: CFSTI

Technical progress on individual projects is summarized. Research is reported on the following investigations and equipment: a pressure compensating system for deep ocean transducers; a balloon-borne system for measuring water vapor and ozone concentrations; corrosion tests of mild steel in dilute NaOH solutions; a gas chromatographic on-column concentrating technique for analysis of halocarbons in closed atmospheres; equipment for measuring dispersion and interaction impedance on TWT circuits; materials and techniques for manufacturing high power X-band TWT amplifiers; with helical structures; thermal fatigue characteristics of metal–ceramic composites; effect of thermal processes on low temperature electrical resistivity of metals; oxidation of Ni–Cr eutectic composite; design principles for fracture-safe steel structures; optimum methods of packing uniform hollow glass spheres for a deep submergent buoyancy system; nitrogen(II) and carbon(II) resonance multiplet line shapes; and computerized simulations of high frequency over-the-horizon radar backscatter profiles and the radiation pattern a circular or cylindrical an antenna array. N.E.N.

N70-12194*# California Univ., La Jolla. Dept. of Applied Electrophysics.
QUANTUM-LIMITED DETECTION OF AN INCOHERENT OBJECT WITH A LORENTZ SPECTRUM
Carl W. Helstrom 15 Mar. 1969 8 p refs
(Grant NGR-05-009-079)
(NASA-CR-107042) Avail: CFSTI CSCL 20F

When the appropriate quantum threshold detectors are used, an object emitting incoherent light with a Lorentz spectrum has a lower probability of detection in the presence of thermal background light than an object emitting light with a rectangular spectrum of the same bandwidth. Author

N70-12211# Hamburg Univ. (West Germany). Inst. für Angewandte Physik.
OSCILLOSCOPE INVESTIGATIONS OF ELECTRIC BREAKDOWN IN KBr CRYSTALS BY MEANS OF ELECTRON AVALANCHES [OSZILLOGRAFISCHE UNTERSUCHUNGEN DES ELEKTRISCHEN DURCHSCHLAGS IN KBr-KRISTALLEN MIT HILFE VON ELEKTRONENLAWINEN]
Martin Zelm (Ph.D. Thesis) 1968 35 p refs In GERMAN
Avail: CFSTI

A method is described for the generation of electron avalanches in KBr crystals and the measurement of the avalanche current. From the avalanche current the electron mobility and the collision ionization coefficient can be determined. By means of measuring the time dependence of the discharge it was intended to answer the question whether a connection exists between the electron avalanches and the electric breakdown. Some qualitative statements can be made concerning the discharge mechanism. ESRO

N70-12219# European Space Research and Technology Center, Noordwijk (Netherlands).
MAGNETIC TESTING OF SPACECRAFT
O. G. Feil and E. Wunderer May 1969 31 p refs Presented at the 6th ESRO Summer School, Noordwijk, Neth., 1968
(ESRO-TN-75) Avail: CFSTI

The principal methods of measuring magnetic fields and magnetic moments are outlined and the types of magnetometer used in spacecraft testing are indicated. In addition, the practical application of the most common measuring method to the testing of boxes for a magnetically clean satellite is described. Author (ESRO)

N70-12270# Hamburg Univ. (West Germany). Mathematisch-Naturwissenschaftliche Fakultät.
UPPER BOUNDARIES FOR THE LIMIT FIELD STRENGTH IN INFINITELY LONG RECTANGULAR BARS [OBERE SCHRANKEN FUER DIE GRENZFELDSTAERKE IN UNENDLICH LANGEN RECHTECKSTAEBEN]
Karl Heinz Sarges (Ph.D. Thesis) 1969 61 p refs In GERMAN
Avail: CFSTI

The estimate or the stability limit of magnetization in an infinitely long ferromagnetic bar is improved by solving a linear homogeneous system of equations for polynomials which describe the deviation of magnetization from the axis of the bar. The lowest eigenvalue of the equations is calculated numerically by a TR 4 computer and represents an upper boundary for the stability limit, which differs from the actual value of the polynomial, i.e. the lower the value the higher the degree. ESRO

N70-12282*# University of Southern Calif., Los Angeles. Dept. of Physics.
THE MEASUREMENT OF OPTICAL CONSTANTS IN THE VACUUM UV REGION Final Report, 1 Nov. 1961–30 Jun. 1969
G. L. Weissler 15 Oct. 1969 34 p refs
(Grant NsG-178-61)
(NASA-CR-107043; TR-USC-VacUV-119) Avail: CFSTI CSCL 20F

The techniques used with a combination of an ultrahigh vacuum Seya monochromator with an ultrahigh vacuum reflectometer are described, and experiments in which they will be used are discussed. Sources of surface contamination are eliminated by choosing the proper materials for construction and making the appropriate selection of pumps. This system was constructed of stainless steel type 304 with all heliarc welding and all of the gaskets were made of OFHC copper. The sorption type forepumps used no oil and therefore eliminated one of the serious sources of contamination present in conventional vacuum systems. Following along similar lines, a liquid nitrogen cold trap in conjunction with a titanium sublimator and an ion pump were chosen because their pumping action did not introduce contaminants. A reproducible vacuum of the desired order was achieved after a bake-out followed by periodic use of the titanium sublimator in conjunction with the cold traps. The pressure of the system was monitored by a nude Bayard--Alpert gauge and continually indicated a reading in the desired range. Author

N70-12283# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
NANOSECOND OPTOELECTRONICS [OPTOELECTRONIQUE NANOSECONDE]
Daniel Zenatti (Ph.D. Thesis) Aug. 1969 21 p refs In FRENCH
(CEA-BIB-161) Avail: CFSTI

The principal transmitting and receiving devices for nanosecond optoelectronics which are available at the present time are briefly described and their respective characteristics are presented. Author (ESRO)

N70-12289# Helsinki Univ. (Finland).
WAVE PROPAGATION IN ANISOTROPIC MEDIA, PART 10
Pentti Mattila 3 Jan. 1968 63 p
Avail: CFSTI

The Fermat variational principle is applied to propagation in isotropic media, and the equations for group path are computed. Results are then extended to propagation in anisotropic media and the group path determined, the end points being fixed. ESRO

N70-12290# Hamburg Univ. (West Germany). Mathematisch-Naturwissenschaftliche Fakultät.
ON AN APPARENT WEAKENING OF LOCALITY CONDITIONS . [UEBER EINE SCHEINBARE ABSCHWAECHUNG DER LOKALITAETSBEDINGUNG]
Manfred Scheunert (Ph.D. Thesis) 1969 29 p refs In GERMAN
Avail: CFSTI

In a relativistic scalar field it is possible to obtain, by a suitable real Lorentz transformation, functions of three space-time points, which are holomorphic in the semi-plane $Re\lambda)0$ and polynomially limited under some additional restrictions. It is proved that these properties also hold for n-point functions by departing from the Wightman functions and it is shown that a weakened form of weak locality implies weak locality. ESRO

N70-12314# Woods Hole Oceanographic Institution, Mass.
A REPORT ON R/V CHAIN CRUISE 89, MARCH AND APRIL 1969. SOUND VELOCITY PROFILES
E. O. La Casce, T. L. Whalen, and J. C. Beckerle May 1969 71 p refs
(Grants Nonr-4029 (00); Nonr-2866(00))
(AD-693036; WHOI-REF-69-26) Avail: CFSTI CSCL 20/1

On Cruise No. 89 of R/v CHAIN from 11 March 1969 to 10 April 1969 approximately sixty sound velocity profiles, SVP No. 625 to SVP No. 685 were obtained in the ocean south and southwest of Bermuda. Some of these profiles are at the same stations visited on Cruise No. 22 of R/v ATLANTIS II in June- August 1966. Tests on a deep hydrophone system and a preliminary study of the use of sound signals to monitor the time variation in sound velocity in the ocean were also made. An evaluation of the sound velocity profiling equipment designed jointly by WHOI and the Sylvania Corporation under shipboard conditions was obtained. Final plots of the measurements were available immediately during the cruise. Author (TAB)

N70-12356# Naval Research Lab., Orlando, Fla. Underwater Sound Research Lab.
ELECTROACOUSTIC TRANSDUCERS FOR A 10,000-PSIG UNDERWATER SOUND TRANSDUCER CALIBRATION FACILITY FOR THE FREQUENCY RANGE 10 TO 40 Hz Interim Report
Ivor D. Groves, Jr. and Theodore A. Henriquez 15 Aug. 1969 25 p refs
(AD-693051; NRL-6967) Avail: CFSTI CSCL 20/1

The design and construction of the terminal and source transducers, a reciprocal spherical piezoelectric ceramic transducer, and the probe hydrophones that are part of a new USRD measuring facility are described. The facility is used for the calibration of under water sound transducers in the frequency range 10 to 4000 Hz at hydrostatic pressure to 10,000 psig and controlled temperature from 3 to 45C. It operates on the principle of active-impedance termination in a rigid-walled, water-filled tube. Author (TAB)

N70-12372# Washington Univ., Seattle. Dept. of Physics.
RENORMALIZEABILITY OF MASSIVE NON-ABELIAN GAUGE FIELDS: A FUNCTIONAL INTEGRAL APPROACH
David G. Boulware 1968 60 p refs
(Contract AT(45-1)-1388)
(RLO-1388-553) Avail: CFSTI

The renormalizability of massive non-Abelian vector gauge fields is discussed using a functional integral technique. The ideas are first developed for the case of a neutral vector meson coupled to a conserved current, where the renormalizability holds. The non-Abelian vector field is written as the gauge transform of a four dimensionally transverse field and the transverse and gauge variables are then treated separately. It is shown that the renormalizability depends solely on that of the gauge variables, which are found to be nonrenormalizable; hence, neither is the field theory. The gauge variables alone provide a representation of the delta-model and of Sugawara's theory of currents which are thus shown to be nonrenormalizable theories. Author (NSA)

N70-12374*# Southampton Univ. (England). Inst. of Sound and Vibration Research

A COMPUTATIONAL STUDY OF ROTATIONAL NOISE

S. E. Wright and H. K. Tang May 1969 163 p refs

(Grant NGR-52-025-002)

(NASA-CR-66869; Avail: CFSTI CSCL 20A

The purpose of this present report is to give in graphical form the computed output of an extensive computational study of rotational noise. No attempt however is made to interpret the output in any way or discuss its implications. The computation covers the properties of blade loading harmonic radiation for a wide range of rotor parameters, including near field, distributed loading both chord and span, and for tip speed in excess of Mach one. The investigation then considers composite blade loading radiation, both simple and compound. Finally the radiation is computed for an ensemble of blade loading harmonics corresponding to well-defined blade loading azimuth functions, similar to those produced by blade slap and rotor/stator interactions. The study although designed for a particular rotor (helicopter), has sufficient scope to cover geometries of other rotor configurations. Author

N70-12387# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aero Propulsion Lab.

THE EFFECT OF 14 MeV NEUTRON HEAT DEPOSITION ON Nb3Sn

Charles E. Oberly Jul. 1969 55 p refs

(AD-692775; AFAPL-TR-68-147) Avail: CFSTI CSCL 20/3

A Nb3Sn superconductive tube was irradiated with 14 Mev neutrons. The magnetic flux flow was greatly enhanced during the irradiation. Localized hot spots induced by the energetic neutrons are postulated as the mechanism for this enhanced flux flow. A brief description of the experimental apparatus is included; other real- and potential neutron irradiation effects on superconductors are discussed. Author (TAB)

N70-12412# Wisconsin Univ., Madison. Dept. of Geology and Geophysics.

CORRELATION OF ACOUSTIC SIGNALS SCATTERED T A ROUGH SURFACE

C. S. Clay Jul. 1969 53 p refs *Its* Contrib. No. 241

(Contract N00014-67-A-1028-0009)

(AD-693115; RR-69-1) Avail: CFSTI CSCL 20/1

The cross correlation and covariance of the acoustic signals reflected from a statistically-rough surface is given. The transition from small roughness to large roughness if given for a randomly corrugated surface. The sound reflected and scattered at each sub-area were separated into coherent and incoherent components. It was necessary to add the coherent components from the sub-areas coherently. The incoherent components were added incoherently. Numerical examples are given to show the magnitude of the signals scattered from the sub-areas. The covariance of signals observed at a pair of receivers are given as a function of the separation. The conditions of applicability of the theory to a geophysical problem have shown that: (1) The upper limit on the size of sub-areas is given by the lambda/8 criteria for the plane wave approximation. (2) The lower limit is given by the requirement that the dimensions of the sub-area be many correlation distances of the rough surface. (3) Far field conditions require that the source and receiver be many acoustic wave lengths from the surface. Author (TAB)

N70-12453# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.

FOCUSING PROPERTIES OF HOMOGENEOUS MAGNETIC FIELD BOUNDARY

P. Frants and Ya. Krzhemenek Apr. 1969 27 p refs In RUSSIAN

(UJV-2178-F) Avail: AEC Depository Libraries

The focusing properties of a uniform mangetic field pole edge, acting on a beam of charged particles, were investigated analytically. The focal curves were found for the straight edge and the resolving power was computed as a function of energy. More details, such as the influence of the source, slits, and detector dimensions are discussed also. Formulas are presented suitable for the design of charged particles magnetic analyzers. Author (NSA)

N70-12548# Hamburg Univ. (West Germany). Mathematisch-Naturwissenschaftliche Fakultät.

CAUSAL LORENTZ SPACES [KAUSALE LORENTZRAEUME]

Hans-Jürgen Seifert (Ph.D. Thesis) 1968 63 p refs In GERMAN

Avail: CFSTI

In the general theory of relativity the causality must be described in a way independent of the metrics, but its effect on the metrics must be established explicitly. Here, structures of the general theory of relativity are considered, which are given by a manifold with a metrics. Properties of causality and its relationships to the manifold structure are discussed. The requirement of regularity in causality is independent of the same requirement for the metrics. The general results are applied to sub-manifolds and the importance of a causality in the mathematics of Lorentz manifolds is stressed. ESRO

N70-12615*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

METHOD AND APPARATUS FOR ALIGNING A LASER BEAM PROJECTOR Patent Application

Michael S. Shumate, James A. Westphal, and Lewis H. Allen, inventors (to NASA) Filed 9 Jul. 1969 15 p

(Contract NAS7-100)

(NASA-Case-NPO-11087; US-Patent-Appl.-SN-840359) Avail: CFSTI CSCL 20F

Revealed are a method and apparatus for aligning a laser beam projector of a type employing an astronomical telescope for directing a laser beam toward a celestial target. The invention employs a beam splitter disposed in a focal plane of the output lens of an astronomical telescope. The beam splitter is so arranged as to reflect light emanating from the target into a second lens system for accommodating visual observation. The beam splitter is provided with a microscopic opening through which is delivered laser light, as the light is generated by a laser generator and focused by a condensing lens to impinge upon the output lens of the telescope. By interposing a beam splitter within the path of the laser light and the path of the light emanating from the target, for reflecting the light to the second system, alignment visually may be confirmed by observing the symmetry of the target image relative to the opening in the beam splitter. NASA

N70-12651# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

MODIFICATION OF A NORMAL SHOCK BY ELECTROSTATIC FORCES

G. F. Butler 1969 24 p refs Supersedes RAE-TR-69040; (ARC-CP-1058, RAE-TR-69040) Avail: HMSO 5s 6d; BIS $1.10

The suggestion that the sonic bang may be alleviated by electrostatic means is examined and several objections to the idea are put forward. At the same time, some theoretical aspects of supersonic electrogasdynamics are investigated and the results presented. Author (ESRO)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N70-11484# Ballistic Research Labs., Aberdeen Proving Ground, Md. Terminal Ballistics Lab.
APPLICATION OF GREEN'S FUNCTION ANALYSIS TO THE SOLUTION OF THE NEUTRON DIFFUSION EQUATION IN HETEROGENEOUS SYSTEMS
Norman E. Banks and G. Lansing Blackshaw (West Virginia Univ.) Jul. 1969 157 p refs
(AD-692828; BRL-1444) Avail: CFSTI CSCL 18/11

The general time-dependent, one-velocity neutron diffusion equation is formulated in generalized three-dimensional coordinates for bare heterogeneous systems containing N very thin heterogeneities. This diffusion equation is written first in the Heaviside notation and subsequently transformed to a Dirac delta function representation. Greens function integral techniques are then applied to determine the solution. Author (TAB)

N70-11503*# Arizona Univ., Tucson. Dept. of Physics.
INNER SHELL IONIZATIONS BY PROTON IMPACT
J. D. Garcia [1968] 25 p refs Sponsored in part by AEC and ONR
(Grant NGR-03-002-017)
(NASA-CR-106833) Avail: CFSTI CSCL 20H

Cross sections for production of inner shell vacancies in atoms by proton impact have been examined in an impulse approximation. The model used includes modifications to account for the nuclear repulsion of the proton. Comparisons with experiment and with other calculations are made. It is found that the model compares favorably with existing Born approximations. If the most recent fluorescent yield data are used, the present results agree well with experiment for proton energies larger than approximately 300 times the electron binding energies. Determination of fluorescent yields by means of such experiments is also discussed. Author

N70-11547*# Arizona Univ., Tucson. Dept. of Physics.
THE MEAN LIVES OF SOME EXCITED LEVELS IN NITROGEN 1
W. S. Bickel, Jean Desesquelles, H. G. Berry, and S. Bashkin [1968] 14 p refs Sponsored in part by ONR
(Grant NGR-03-002-017)
(NASA-CR-106837) Avail: CFSTI CSCL 20H

Measured were the mean lives of two low quartet and two low doublet excited levels of N 1 using the beam foil technique. The transitions observed, their wavelengths in A, and the mean lives of the upper levels in nanoseconds are shown on tables. Author

N70-11550*# Arizona Univ., Tucson. Dept. of Physics.
BEAM-FOIL SPECTRUM OF NITROGEN AT ULTRAVIOLET WAVELENGTHS
H. G. Berry, W. S. Bickel, J. Desesquelles, S. Bashkin, and R. M. Schectman [1968] 29 p refs Sponsored in part by ONR
(Grant NGR-03-002-017)
(NASA-CR-106834) Avail: CFSTI CSCL 20H

An analysis is presented of the spectra seen in a foil-excited nitrogen beam accelerated by Van de Graaff accelerators. Atomic and molecular beams were accelerated to energies of 0.25 to 2.0 MeV to observe spectra in the wavelength region wavelength 1050A – wavelength 2600A. Atomic nitrogen was accelerated at higher energies up to 5.5 MeV to study the wavelength region wavelength 2000A – wavelength 5000A. Decay times of twenty-one of the stronger lines of N II to N V in both these regions were measured. Author

N70-11575*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALPHA-GAMMA ANGULAR CORRELATIONS IN THE REACTION CARBON 12(ALPHA, ALPHA PRIME GAMMA/4.433 MeV)
William M. Stewart, Norton Baron, Richard C. Braley, and Regis F. Leonard Washington Nov. 1969 30 p refs
(NASA-TN-D-5568; E-5033) Avail: CFSTI CSCL 20H

The angular correlation between inelastically scattered 41.2 MeV alpha particles and gamma rays emitted in the decay of the target nucleus has been measured for alpha scattering angles between 26 deg and 95 deg. The results are given in the form of A/B ratios and symmetry angles of the gamma ray distribution for a fixed alpha scattering angle. All measurements are in the plane of the original alpha scattering. In an auxilliary experiment the cross sections for both the elastic and inelastic (Q = 4.433 MeV) scattering have also been measured. Neither the cross sections nor the correlations are correctly predicted by theory. Author

N70-11614*# Australian National Univ., Canberra. Research School of Physical Sciences.
STARK EFFECT IN He 2 AND H
S. Bashkin and G. W. Carriveau [1968] 14 p refs Sponsored in part by ONR
(Grant NGR-03-002-017)
(NASA-CR-106840; ANU-P/468) Avail: CFSTI CSCL 20H

The beam foil light source was used for a study of the Stark effect on He (wavelength 4686 A) and H. For the former, the p- and s-components were detected for transverse and longitudinal fields. The transverse field data suggest that levels of high j are under-populated relative to their equilibrium numbers. The longitudinal field data are anomalous. For H, splitting was observed but the arrangement precluded the detection of polarization. The data also imply underpopulation of levels of high j. Author

N70-11625# Sao Paulo Univ. (Brazil). Dept. of Physics
DEUTERON AND PROTON REACTIONS AT 3.6 MeV Final Technical Report
O. Sala 6 Aug. 1969 8 p refs
(Grant AF-AFOSR-310-67)
(AD-693222; AFOSR-69-2161-TR) Avail: CFSTI CSCL 20/8

The main line of research developed was the study of deuteron induced reactions on light elements. TAB

N70-11742# Australian National Univ., Canberra. Research School of Physical Sciences.
SPIN OF THE 426 keV LEVEL IN Cu-62
W. F. Davidson, P. J. Dallimore, and J. Hellstroem [1969] 10 p refs
(ANU-P/470) Avail: CFSTI

A beam of protons from a tandem Van de Graaff accelerator was directed onto an approximately 0.9 mg per sq cm isotopically enriched Ni-62 target prepared by vacuum evaporation of the material onto a backing of 0.005 in. tantalum foil. With the target angled at 45 deg to the incident beam, this thickness of nickel corresponds to approximately 60 keV energy loss. With the Q-value of the Ni-62(p,n) reaction being −4.721 MeV, adjustment of the proton bombarding energy to 5.34 MeV enabled the level at 426.1 keV to be populated by neutrons with an energy of approximately 50 to 100 keV. Exit neutrons of this energy are essentially all s-wave and there exists minimum de-alignment of the final state. The spin of the 426 keV level in Cu-62 excited through the Ni-62(p,n gamma)Cu-62 reaction was measured at 3(+). Author

N70-11743# Australian National Univ., Canberra. Research School of Physical Sciences.
HYSTERESIS FREE RANGING OF VAN DE GRAAFF BEAM ENERGY
Harlan W. Lefevre [1969] 7 p refs
(ANU-P/465) Avail: CFSTI

An air core trimmer coil is described which is used to add or subtract an incremental deflection to the analyzed beam from a Van de Graaff accelerator. Such an additive deflection works

back through the standard slit current-corona feedback system to change terminal voltage in a predictable way. The technique is inexpensive, and with a stable machine, it perhaps offers better energy resolution than is usually obtained from a nuclear magnetic resonance spectrometer of average performance. Author

N70-11744# Australian National Univ., Canberra. Research School of Physical Science.

DIFFERENTIAL CROSS-SECTIONS FOR THE REACTION Mg-26(TAU, ALPHA)Mg-25 MEASURED AT E(TAU) EQUALS 10.2 MeV

J. Nurzynski [1969] 18 p ref

(ANU-P/454) Avail: CFSTI

Differential cross sections for the Mg-26(tau,alpha)Mg-25 reaction leading to the ground state and to the 0.584, 0.976, 1.611, and 1.962 MeV excited states in Mg-25 were measured using a beam of 10.2 MeV He-3 particles (tau) accelerated in the Australian National University tandem accelerator. The angular distributions of alpha particles from the reaction were measured by three surface barrier silicon detectors mounted on a triple slit holder at a distance of approximately 10.4 cm from the target. Reaction products were collimated on each detector using two rectangular 3 times 12 sq mm slits and one rectangular antiscattering baffle. Relative errors of the cross sections include statistical and current integrator inaccuracies. The uncertainty of the absolute values of the cross sections is estimated at + or - 6%. Author

N70-11816# Atomic Energy Board, Pretoria (South Africa).

A READING LIST ON THE APPLICATIONS OF ISOTOPES IN INDUSTRY (MECHANICAL ENGINEERING)

G. C. Snyman and Marietha Van Rooyen Apr. 1969 33 p refs

(PEL-189) Avail: CFSTI

References (187) on the uses of radioisotopes in mechanical engineering are given to books, conferences, reports, and journals published from 1956 through 1968. A subject index is included. NSA

N70-11819# Stanford Linear Accelerator Center, Calif.

TWO MILE ACCELERATOR PROJECT Quarterly Status Report, 1 Jan. - 31 Mar. 1969

Jun. 1969 80 p refs

(Contracts AT(04-3)-400; AT(04-3)-515)

(SLAC-105) Avail: CFSTI

A status report on the Stanford Linear Accelerator Project covering the period January 1, 1969 to March 31, 1969, is presented. Topics included are accelerator and research area operations, accelerator and research area equipment development, and physics research equipment development. Author (NSA)

N70-11821# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.

ATOMIC TRANSITION PROBABILITIES, VOLUME 2: SODIUM THROUGH CALCIUM

W. L. Wiese, M. W. Smith, and B. M. Miles Oct. 1969 209 p refs Sponsored by ARPA

(NSRDS-NBS-22-Vol-2) Avail: SOD $4.50

Atomic transition probabilities for about 5,000 spectral lines of the second ten elements, based on all available literature sources, are critically compiled. The data are presented in separate tables for each element and stage of ionization. For each ion the transitions are arranged according to multiplets, supermultiplets, transition arrays, and increasing quantum numbers. Allowed and forbidden transitions are listed separately. For each line the transition probability for spontaneous emission, the absorption oscillator strength, and the line strength are given along with the spectroscopic designation, the wavelength, the statistical weights, and the energy levels of the upper and lower states. In addition, the estimated accuracy and the source are indicated. In short introductions, which precede the tables for each ion, the main justifications for the choice of the adopted data and for the accuracy rating are discussed. A general introduction contains a detailed discussion of the critical factors entering into each major experimental and theoretical method. It also includes a general critical assessment of the widely used Coulomb approximation, and a number of illustrative examples for the explanation of regularities or systematic trends among oscillator strengths. Author

N70-11825# Australian National Univ., Canberra. Research School of Physical Sciences.

EVIDENCE FOR THE INTERPRETATION OF THE SELECTIVE OCCURRENCE OF INTERMEDIATE STRUCTURE IN EXCITATION FUNCTIONS FROM THE REACTION Na-23(p, p PRIME) Na-23

J. Hellstroem, P. J. Dallimore, and W. F. Davidson [1969] 9 p refs

(ANU-P/467) Avail: CFSTI

The selective occurrence of intermediate structure in the compound nucleus Mg-24 observed in the excitation functions for decay through different exit channels is interpreted on the basis of the statistical model of intermediate structure of Moldauer and the compound nucleus theory of Hauser and Feshbach. Author

N70-11876# Los Alamos Scientific Lab., N.Mex.

REPORTS TO THE AEC NUCLEAR CROSS SECTIONS ADVISORY COMMITTEE

M. S. Moore comp. 1968 244 p refs Meeting held at New York, 21-23 Oct. 1968

(WASH-1124) Avail: CFSTI

CONTENTS:

1. ACCELERATOR PROGRAMS, PILE NEUTRON PHYSICS, AND NUCLEAR THEORY p 1-10 refs (See N70-11877 02-24)

2. NEUTRON PHYSICS AND NATIONAL NEUTRON CROSS SECTION CENTER p 11-21 ref (See N70-11878 02-24)

3. NEUTRON PHYSICS AND CHARGED PARTICLE PHYSICS p 22-24 refs (See N70-11879 02-24)

4. FAST NEUTRON PHYSICS, SLOW NEUTRON PHYSICS, AND NEUTRON, AND GAMMA-RAY PHYSICS p 25-35 (See N70-11880 02-24)

5. NEUTRON CROSS SECTION MEASUREMENTS, FISSION MEASUREMENTS, AND THE PR-141 (GAMMA, n) p 36-48 refs (See N70-11881 02-24)

6. CROSS SECTION MEASUREMENTS p 49-80 refs (See N70-11882 02-24)

7. PULSED SPHERE PROGRAM p 81-94 refs (See N70-11883 02-24)

8. NEUTRON PHYSICS AND CHARGED PARTICLE REACTIONS p 95-98 refs (See N70-11884 02-24)

9. NEUTRON STUDIES, CHARGED PARTICLE STUDIES, AND INSTRUMENTATION AND FACILITIES p 99-130 refs (See N70-11885 02-24)

10. NEUTRON PHYSICS AND INSTRUMENTATION p 131-132 (See N70-11886 02-24)

11. DIFFERENTIAL GAMMA-RAY PRODUCTION CROSS SECTIONS AND TOTAL CROSS SECTION MEASUREMENTS p 133-135 ref (See N70-11887 02-24)

12. NEUTRON ELASTIC AND INELASTIC SCATTERING p 136-161 refs (See N70-11888 02-24)

13. NEUTRON CAPTURE IN FE AND CR TO 400 KEV p 152-166 refs (See N70-11889 02-24)

14. NEUTRON PHYSICS p 167-175 refs (See N70-11890 02-24)

15. NEUTRON PHYSICS, EQUIPMENT, AND COMPUTATIONAL AND THEORETICAL STUDIES p 176-190 refs (See N70-11891 02-24)

16. NEUTRON PHYSICS AND CHARGED PARTICLE

REACTIONS p 191–211 refs (See N70-11892 02-24)

17. NEUTRON TIME-OF-FLIGHT STUDIES, PHOTONUCLEAR REACTIONS (CHARGED PARTICLE EMISSION), ELECTRON SCATTERING, AND THEORETICAL DEVELOPMENTS p 212–227 refs (See N70-11893 02-24)

N70-11877# Argonne National Lab., Ill.
ACCELERATOR PROGRAMS, PILE NEUTRON PHYSICS, AND NUCLEAR THEORY
In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 1–10 refs (See N70-11876 02-24)
Avail: CFSTI

Accelerator programs depict work on microscopic neutron cross section measurements, fast neutron scattering spectrography by time-of-flight from spherical and deformed nuclei, and polarization and fission calculation work and experiments on radioactive elements. Gamma ray spectra were obtained for the decay of nuclear configurations of silicon, aluminum, and platinum. Nuclear spectroscopy continued with resonance and fission transition measurements on various isotopes in an effort to correlate neutron spectra and partial radiative widths. A hydrodynamic model was used to obtain the radiative strength function of platinum 169 from experimental data. G.G.

N70-11878# Brookhaven National Lab., Upton, N.Y.
NEUTRON PHYSICS AND NATIONAL NEUTRON CROSS SECTION CENTER
In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 p 11–21 Ref (See N70-11876 02-24)
Avail: CFSTI

Measurements of neutron induced gamma ray spectra were extended by modifications to the chopper system and detector geometry. Correlation expressions were formed for thermal and resonance spectra in various neutron-gamma interactions and deviations from random matrix capture widths data were examined. Nuclides in the region of the P-wave strength maximum were studied with the 48.8 meter flight path by germanium detectors. Also reported were new instrumentation developments for capture gamma ray investigations and particle polarization measurements. Development of a data storage and retrieval system continued and results from a pilot system were found encouraging. G.G.

N70-11879# Case Western Reserve Univ., Cleveland, Ohio.
NEUTRON PHYSICS AND CHARGED PARTICLE PHYSICS
In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 p 22–24 refs (See N70-11876 02-24)
Avail: CFSTI

The elastic and inelastic scattering of partially polarized neutrons from pure nuclides was reanalyzed and the effects of polarization were included. The multiple scattering Monte Carlo code was also modified to include the effects of polarization. A program of neutron elastic and inelastic scattering in the energy region 4 to 5.5 MeV continued. Measurement results on proton-proton bremsstrahlung at 3.2 MeV were corrected for detector acceptance angle. Deuteron induced reactions and scattering from carbon 13 produced several strong resonances which seemed to indicate that the reaction proceeded via the compound nucleus. G.G.

N70-11880# Columbia Univ., New York.
FAST NEUTRON PHYSICS, SLOW NEUTRON PHYSICS, AND NEUTRON, AND GAMMA-RAY PHYSICS
In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 p 25–35 (See N70-11876 02-24)
Avail: CFSTI

Fast neutron time-of-flight spectroscopy centered on the Ne20 (He3,n)Mg22 reaction and its strong energy dependence on spatial distribution. The electronics for a gamma counter array system in connection with the spectroscope are shown in block diagrams and recent work with the (n-gamma) array system on the Ne20(He3,n)Mg22 reaction is described. Gamma ray decay observations of analog states in 28Si were obtained via the 27Al(d,n) reaction. A Monte Carlo computer program has been developed for studying total neutron cross sections of oxygen at 2.37 MeV. Work for slow neutron physics centered mainly on neutron resonance cross section measurements on 26 separated isotopes and 14 natural metals; also investigated were fission fragment mass distributions and their kinetic energy. Numerical studies have been made on the effect of anti-resonance on neutron transport and cross section parameters. G.G.

N70-11881# Gulf General Atomic, San Diego, Calif.
NEUTRON CROSS SECTION MEASUREMENTS, FISSION MEASUREMENTS, AND THE PR-141 (GAMMA,n) CROSS SECTION
In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 p 36–48 refs (See N70-11876 02-24)
Avail: CFSTI

Work is in progress on the problem of making accurate neutron spectra measurements for time-of-flight experiments in the 1-1000 keV region for capture cross section determinations. Average capture cross sections were obtained for helium 3, gadolinium, rhenium, gold, zirconium, uranium, and tungsten. The reduction of delayed gamma effects and uncertainties in relative detector efficiencies for fission and capture measurements on 239 plutonium and 252 californium are discussed. Beam-foil measurements of the 141 praseodymium (gamma-neutron) cross section were in agreement with earlier measurements. G.G.

N70-11882# Idaho Nuclear Corp., Idaho Falls.
CROSS SECTION MEASUREMENTS
In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 p 49–80 refs (See N70-11876 02-24)

Neutron cross section measurements are reported on 147 promethium, 99 and 170 technetium, as well as several scattering cross sections measurements of fissile nuclides. Experimental time with the new scandium beam was used to measure various fissile nuclei at 2 keV. Capture gamma ray studies continued with emphasis on reactor shielding problems. Sixteen excited states up to 1818 keV were located in the deformed even-even nucleus 178 hafnium during resonance neutron capture gamma ray studies. G.G.

N70-11883# California Univ., Livermore. Lawrence Radiation Lab.
PULSED SPHERE PROGRAM
In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 p 81–94 refs (See N70-11876 02-24)
Avail: CFSTI

The analysis of the neutron spectrum for 1.1 mean free path of liquid nitrogen in a spherical container was completed and experimental results for cross sections agreed with predicted values. Threshold photoneutron cross section measurements were obtained for various isotopes as a function of photon energy from 2 keV to 3.5 MeV above threshold. Photoneutron cross sections were also measured for some deformed nuclei as a function of photon energy from 8 to 29 MeV. Nuclear information extracted from these data included giant resonance parameters, integrated cross sections and their moments, symmetry energies, quadrupole moments, and level densities. A deuterated benzene based liquid scintillator viewed by a photomutiplier was developed and used to measure, capture and fission cross sections simultaneously. G.G.

N70-11884# Lockheed Missiles and Space Co., Palo Alto, Calif.
NEUTRON PHYSICS AND CHARGED PARTICLE REACTIONS

In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect Advisory Comm. 1968 p 95–98 refs (See N70-11876 02-24)
Avail: CFSTI

Reported are remeasurements on gold 197 (neutron,gamma) and gold 198 activation cross sections at about 575 keV. Studies on charged particle reactions covered measurements and analyses of excited states in the beryllium 7 (proton,gamma) beryllium 8 reaction, the silicon 30(t, alpha gamma) aluminum 29 reaction, beta decays in calcium 50 as well as in various 2s-1d shells, and life time measurements by Doppler shift attentuation on excited states in sodium 23, aluminum 27, aluminum 29, fluorine 19, and other elements. G.G.

N70-11885# Los Alamos Scientific Lab., N.Mex.
NEUTRON STUDIES, CHARGED PARTICLE STUDIES, AND INSTRUMENTATION AND FACILITIES
In its Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 p 99–130 refs (See N70-11876 02-24)
Avail: CFSTI

A summary of experiments performed on nuclear explosion time-of-flight spectrometry is given in table form and contains the various measured cross sections and energy ranges. Cross sections for the production of gamma rays by neutrons between 4 and 7.5 MeV are also presented for a number of uranium and plutonium isotopes. Charged particle studies encompass neutron and proton pairing energies, proton and triton scattering from isotopic targets, as well as fission cross sections and fragment angular correlations for isotopic thorium, uranium, and plutonium targets. Instrumentation and facility improvements are described for a fast neutron telescope, and for a source of polarized hydrogen ions. G.G.

N70-11886# National Bureau of Standards, Boulder, Colo.
NEUTRON PHYSICS AND INSTRUMENTATION
In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 p 131–132 (See N70-11876 02-24)
Avail: CFSTI

Thermal neutron absorption cross section data were reviewed and updated. The linac operation was improved by relocation of quadrupole magnets and the addition of beam viewing screens. A high speed photodiode analysis of the beam pulse shape demonstrated high current operation with beam pulses no longer than 1.2 nanoseconds. G.G.

N70-11887# Naval Radiological Defense Lab., San Francisco, Calif.
DIFFERENTIAL GAMMA-RAY PRODUCTION CROSS SECTIONS AND TOTAL CROSS SECTION MEASUREMENTS
In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 p 133–135 ref (See N70-11876 02-24)
Avail: CFSTI

Measurements of differential cross sections in the production of gamma rays resulting from (neutron,neutron'gamma) reactions of 2.8 neutrons with silicon, titanium, chromium, and iron were completed and correlated well with theoretical values. Total cross section measurements on sulfur and iron from 1.8 to 2.6 MeV were also obtained; sulfur measurements showed much more structure than earlier measurements in this energy range. G.G.

N70-11888# Oak Ridge National Lab., Tenn.
NEUTRON ELASTIC AND INELASTIC SCATTERING
In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 p 136–151 refs (See N70-11876 02-24)
Avail: CFSTI

The number of detectors in the neutron time-of-flight system was increased and a summary of data taken since March, 1968, is given in table form with listings of the various samples, priorities, and measurement energies. Neutron cross section energies were determined for several isotopes and the new isotopes 230 palladium, 229 palladium, and 155 erbium were produced and identified by half life and gamma particle measurements. Solid state counter data were used to determine the average number of neutrons emitted by fission fragments as a function of fragment mass and total kinetic energy. High energy transport calculations were extended to the two to three GeV range and used to predict thermal neutron flux levels from BeV protons. Also reported were balloon flight measurements on neutron spectra in the upper atmosphere, various proton and alpha particle cross section measurements, Coulomb excitation effects on nuclei, and the preparation of europium targets and thin carbon films for electron foil stripping purposes. G.G.

N70-11889# Rensselaer Polytechnic Inst., Troy, N.Y.
NEUTRON CAPTURE IN FE AND CR TO 400 KEV
In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 p 152–166 refs (See N70-11876 02-24)
Avail: CFSTI

Neutron radiative capture measurements up to 400 keV were performed on several elements and their respective resonances were evaluated and assigned by computer methods. Preliminary (n,n'gamma) measurements were carried out at the linear accelerator to determine the feasibility of germanium(lithium) crystals as detectors. A theoretical phonon frequency distribution has been developed for calculating inelastic scattering cross sections and a Monte Carlo code was written to correct for multiple scattering effects in either slab or turbulent samples. G.G.

N70-11890# Rice Univ., Houston, Tex. Bonner Nuclear Lab.
NEUTRON PHYSICS
In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 p 167–175 refs (See N70-11876 02-24)
Avail: CFSTI

Neutron time-of-flight experiments were prepared by designing a new liquid scintillator neutron counter and a spherical scattering chamber. A pulse shape discriminator has been completed which possesses a detector of low neutron threshold. Few nucleon and many particle breakup studies were observed by coincidence spectra and results were analyzed for excited states and reaction modes. Proton gamma-ray angular correlations were measured on excited states of 43 scandium. Polarized helium gas targets were used for proton scattering studies and measurements of spin-correlation effects. Theoretical work focused on nucleon/nucleon scattering. Work on a polarized 3 He ion source progressed. Parallel plate and position-sensitive multiwire proportional counters were developed together with other improvements for the 6 MW accelerator. G.G.

N70-11891# Texas Nuclear Corp., Austin.
NEUTRON PHYSICS, EQUIPMENT, AND COMPUTATIONAL AND THEORETICAL STUDIES
In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 p 176–190 refs (See N70-11876 02-24)
Avail: CFSTI

Measurements of gamma ray production resulting from neutron bombardment of various elements continued and tentative results are given for sodium, tungsten yttrium, niobium, lead isotopes, and boron-10. Data handling was improved by the addition of a graphical plotter to the computer. Also reported were major Algol language revisions to supply angular distribution coefficients for the differential cross section calculation code. G.G.

N70-11892# Triangle Universities Nuclear Lab., Durham, N.C.
NEUTRON PHYSICS AND CHARGED PARTICLE

REACTIONS

In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 p 191–211 refs (See N70-11876 02-24)

Avail: CFSTI

Total neutron cross section measurements were completed for argon-40, sulfur-34, and calcium-48. Cross section measurements were also made on three samples of differing thicknesses for each of the isotopes neodymium-142,-144,-146,-148 in the energy range of 3 to 200 keV. Energies and neutron escape widths have been calculated for the 2p-1h continuum levels in the compound nuclei calcium-49, strontium-89, and zircomium-91. Also reported are neutron polarization reactions for targets in the 1p shell and the scattering of polarized neutrons from helium. Charged particle reaction work covered a wide range from differential cross sections to excitation functions and resonances. The acceptance test for the the new negative-ion cyclotron has been completed. G.G.

N70-11893# Yale Univ., New Haven, Conn.

NEUTRON TIME-OF-FLIGHT STUDIES, PHOTONUCLEAR REACTIONS (CHARGED PARTICLE EMISSION), ELECTRON SCATTERING, AND THEORETICAL DEVELOPMENTS

In Los Alamos Sci. Lab. Rept. to the AEC Nucl. Cross Sect. Advisory Comm. 1968 p 212–227 refs (See N70-11876 02-24)

Avail: CFSTI

Various energy spectra of photoneutrons were obtained by time-of-flight spectrometer and differential cross sections were determined relative to the deuterium photoneutron cross sections. Charged particle emissions were studied on oxygen, helium, and deuterium. Experiments with an etched cellulose nitrate track detector established its selective response to alphas in the energy range 1 to 5 MeV. Observations of electrons scattered from calcium-40 and calcium-48 have been completed and transition probabilities and radii for several levels were obtained. Theoretical development work was directed towards direct photonuclear reactions in oxygen and coulomb corrections for inelastic electron scattering from nuclei. G.G.

N70-11896# Academy of Sciences (USSR), Moscow.

CRITICAL CURRENTS OF RELATIVISTIC ELECTRON BEAMS

L. S. Bogdankevich, I. Zhelyazkov, and A. A. Rukhadze 1969 13 p refs Submitted for publication 1969 *Its* preprint No. 64

(NP-17964) Avail: AEC Depository Libraries

The problem of critical currents of relativistic electron beams in drift space is investigated. It is shown that the limiting current of an uncompensated beam, restricted by space charge, increases linearly with the growth of electron energy in the relativistic range. The critical currents in compensated beams are determined by the condition for emergence of electrostatic instabilities in the system. The critical currents increase with the growth of electron energy in the relativistic range as E cubed. This makes possible the production of high currents in compensated electron beams. Author (NSA)

N70-11908# Loyola Univ., Chicago, Ill.

REGGE OUTPUT FROM N/D EQUATION WITH REGGE INPUT

G. R. Bart and R. L. Warnock (Argonne Natl. Lab., Ill.) [1969] 8 p refs Presented at Conf. on Regge Poles, Irvine, Calif., 5-6 Dec. 1969 Supported in part by AEC and NSF

Avail: CFSTI

The large s behavior of partial waves in Regge theory can be derived under reasonable assumptions on the large momentum transfer behavior of the amplitude. Thus, Regge theory determines the asymptotic behaviors of the real phase shift sigma (mod pi), the elasticity eta, and the left cut term B(s) of partial waves (up to an additive constant B (infinity)). With Reggebehaved eta and B as input to the inelastic N/D equation, one can ask whether the output phase shift sigma has the asymptotic behavior required by Regge theory. An asymptotic analysis of the equation, which is a Fredholm equation in L(2) yields the surprising result that sigma has Regge behavior if and only if the subtraction constant of the partial wave dispersion relation (equivalently, the constant B(infinity)) satisfies a simple linear constraint. Account should be taken of this fact in Reggeized bootstrap calculations, and in theories where Regge cuts are viewed as absorptive corrections. Author

N70-11915# Australian National Univ., Canberra. Research School of Physical Sciences.

THE DEPENDENCE OF THE SPECTROSCOPIC FACTORS ON PARAMETERS OF DISTORTING POTENTIALS FOR THE REACTION Mg-26(TAU, ALPHA)Mg-25

J. Nurzynski [1969] 29 p refs

(ANU-P/461) Avail: CFSTI

Angular distributions of alpha particles from the reaction Mg-26(tau,alpha)Mg-25 studied at E sub tau = 10.2 MeV were analyzed in terms of DWBA. To avoid the necessity of introducing a lower cut-off radius in the calculation of radial integrals, deep potentials were used. Changes in the potential of the incident particles are found to have only a small influence on the calculated distributions. The fits to the experimental data can be optimized by readjusting one parameter only, namely the depth of the real part of the optical-model potential for alpha particles. The present analysis indicates that the dependence of the ratio of the spectroscopic factors S(l,j)/S sub g.s.(l,j) on the exit channel parameters is weaker (by a factor of from 0.5 to 0.2) than the dependence of the absolute value of the calculated cross sections on the same parameters. Author

N70-11917# Vanderbilt Univ., Nashville, Tenn.

STUDIES OF THE COLLECTIVE STATES IN Gd-152, Sm-152, AND Gd-154

Leo Louis Riedinger, Jr. (Ph.D. Thesis) Jan. 1969 226 p refs Sponsored by AEC

(TID-24876) Avail: CFSTI

Collective excitations in Gd-152, Gd-154, Gd-158, and Sm-152 were investigated by measuring gamma singles and coincidence spectra from the decay of Eu-152, Eu-154, and Eu-158; and the results were compared with the predictions of several macroscopic and microscopic collective models. Previously reported conversion-electron data were used to obtain conversion coefficients, log-ft values, and branching percentages. Transition probabilities were determined, and the experimental E0 matrix elements were used to estimate the change in radius between the 0(+) and 2(+) levels of the ground-state band. The properties of the ground-state rotational bands and the beta- and gamma-vibrational bands were studied in detail. Only preliminary results were obtained for the Eu-158 decay scheme. NSA

N70-11931# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).

EFFECTS OF GROUND-STATE CORRELATIONS ON THE ODD-PARITY STATES OF O-16

G. Do Dang, B. Goulard, and A. Laverne 1969 24 p refs Prepared jointly with Laval Univ.

(Rept-69/59) Avail: CFSTI

Taking into account the mixing of 2p – 2h components in the ground state, a method is developed to define the odd-parity excited states of O-16. Using a Yukawa potential with various mixtures, the excitation energies are given and the components of the wave functions are put in a form which can be readily used for the computation of electromagnetic transition probabilities. The 3p – 3h components in these wave functions are found to be important. Author

N70-11932# Australian National Univ., Canberra. Research School of Physical Science.
THE 4.41 AND 4.51 MeV LEVELS OF 27 Al
K. W. Carter, D. C. Kean, C. J. Piluso, and R. H. Spear [1969] 16 p refs
(AVU-P/455) Avail: CFSTI

The 4.41 and 4.51 MeV levels of Al-27 was studied via angular correlation measurements of the reaction Mg-24 (alpha, proton gamma) Al-27. These levels are found to have spins of 5/2 and 11/2 respectively. The multipole mixing ratios for the 4.41 to 0, 4.41 to 1.01, 4.51 to 2.21, and 4.51 to 3.00 MeV transitions are −0.02 + 0.11 or −0.16, 0.15 + or − 0.13, −0.05 + or − 0.15, and −0.60 + 0.13 or −0.16 respectively. Author

N70-11941*# Australian National Univ., Canberra. Dept. of Nuclear Physics.
BEAM-FOIL SPECTROSCOPY: LECTURES
G. W. Carriveau and S. Bashkin (Arizona Univ., Tuscon) 8 Sep. 1969 70 p refs Presented at Ariz. Univ., Tuscon, Feb.–Mar. 1969 Sponsored in part by NASA
(NASA-CR-106800; ANU-P-452) Avail: CFSTI CSCL 20H

A general review of beam-foil spectroscopy (BFS) methods and applications is presented emphasizing BFS research in atomic physics, wavelength measurements, lifetime measurements, and application of the BFS method in astrophysics. M.H.E.

N70-11954# IIT Research Inst., Chicago, Ill. Dept. of Physics.
CORRECTIONS FOR ABSORPTION IN THE PERIPHERAL MODEL OF HIGH ENERGY PROCESSES, 1 MAY 1967–30 APRIL 1969
Robert L. Warnock Dec. 1968 30 p refs
(Grant NSF GP-7199)
Avail: Issuing Activity

The many-channel N/D equations with arbitrary inelasticity are solved by a general computer program. The nucleon and Roper resonance are used as CDD poles to solve the one-channel D function. Phase shift is determined by the elasticity in certain partial waves of pi-N scattering. Regge asymptotics of the N/D equation were studied as a logical means of incorporating absorptive effects. The work completed shows that known methods of nonlinear functional analysis are effective in solving problems of strong-interaction dynamics. R.B.

N70-11956*# Volt Information Sciences, Inc., Washington, D.C.
CONSTANT OF STEP-BY-STEP IONIZATION OF ATOMS
B. M. Smirnov 27 Aug. 1969 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Fiz. (Moscow), v. 187, no. 4, 1969 p 787–790
(Contract NAS5-12487)
(NASA-CR-106810; ST-NP-AC-10862) Avail: CFSTI CSCL 20H

The constant of step by step ionization in a large discharge tube by way of its dependence on temperature and density of electrons and properties of different atomic gases is established. The ratio of such constants is determined for two such gases. Earlier calculations are proved to be incorrect. Author

N70-11967# Australian National Univ., Canberra. Research School fo Physical Sciences.
SEARCH FOR THE LOWEST T EQUALS 2 STATE OF Be-8: THEORY
F. C. Barker and N. Kumar [1969] 4 p refs Submitted for publication
Avail: CFSTI

Shell model calculations suggest that Li-6+d reactions should be used to search for the lowest T=2 state of Be-8. Author

N70-11968# Australian National Univ., Canberra. Research School of Physical Sciences.
SEARCH FOR THE LOWEST T EQUALS 2 STATE OF Be-8: EXPERIMENTAL
J. L. Black, W. J. Caelli, D. L. Livesey, and R. B. Watson [1969] 7 p refs
(ANU-P/443) Avail: CFSTI

An anomaly with width 10 + or − 3 keV has been observed in the excitation functions for Li-6+d reactions at an excitation energy in Be-8 of 27.483 + or − 0.010 MeV. It is interpreted as being due to the isospin forbidden excitation of the lowest T=2 state of Be-8. Author

N70-11971# California Univ., Livermore. Lawrence Radiation Lab.
METHOD FOR DETERMINING SCINTILLATOR RESPONSE FUNCTIONS FOR FAST NEUTRONS
B. A. Pohl, J. D. Anderson, J. W. Mc Clure, and C. Wong 29 Apr. 1969 10 p refs
(UCRL-50653) Avail: CFSTI

An efficient method for determining the pulse-height response function of organic scintillators for fast neutrons has been developed. A pulsed beam of 14 MeV neutrons from the D–T reaction was generated by the Livermore ICT accelerator; the beam of neutrons was subsequently degraded by scattering in a one mean-free-path block of CH2 to product a time-correlated polyenergetic burst of neutrons. The neutrons were detected at a flight path of 7.5 m with a full width at half maximum (fwhm) time resolution of 3 nsec. The timing error due to the scattering process was negligible compared to the total flight time. Both time-of-flight and pulse-height information were accumulated for each detected event in a two-parameter analyzer. Using this method, the response functions were measured for Stilbene, Pilot B, NE-213, and NE-218 for neutrons with energies between 1 and 14 MeV. From these functions the loci of equivalent electron pulse heights were determined for each scintillator. Author (NSA)

N70-11973*# Arizona Univ., Tucson. Dept. of Physics.
THE BEAM-FOIL SPECTRUM OF SULFUR LAMBDA600-4000ANGSTROM
H. G. Berry, R. M. Schectman, I. Martinson, W. S. Bickel, and S. Bashkin [1968] 42 p refs Sponsored in part by ONR
(Grant NGR-03-002-017)
(NASA-CR-106839) Avail: CFSTI CSCL 20H

The beam foil spectrum of sulfur in the wavelength region 600 to 4000 A has been measured for a series of beam particle energies from 0.5 to 2.0 MeV. Transitions in S I – S VI have been identified. In addition, many strong unidentified sulfur lines were observed and approximate charge states have been suggested by the variation of intensity of these lines with incident particle energy. Mean lives of forty-six of the stronger transitions were measured. Twenty-seven of these correspond to transitions between known levels of S II – S VI. Author

N70-11977# Stevens Inst. of Tech., Hoboken, N.J. Dept of Physics.
EVIDENCE FOR VIOLATION OF THE DELTA I EQUALS 1/2 RULE IN POSITIVE KAON YIELDS 3 PION DECAY
J. Grauman, S. Taylor, E. L. Koller, D. Pandoulas, S. Hoffmaster et al Sep. 1969 8 p refs Submitted for publication
(Contract Nonr-3066(00))
(AD-693624; SIT-0242) Avail: CFSTI CSCL 20/8

A significant violation of the increment I = 1/2 rule was detected in the positive kaon decay into 3 pions. The ratio of the coefficients of the linear terms in the squared matrix elements of tau(+) (positive kaon yields positive pion + 2 neutral pions) and tau(+) (positive kaon yields 2 positive pions + neutral pion) is found to be −2.83 + or −0.18 (as compared to the increment I

= 1/2 rule prediction of −2), when results of the Riverside tau ('+) experiment are used together with the results of the present tau(+) experiment. Author

N70-11979# California Univ., Berkeley.
THE PHI MESON OMEGA MESON AND ETA MESON ETA MESON PRIME PRODUCTION RATIOS IN THE REACTION POSITIVE PION PROTON YIELDS DELTA (2 PLUS) PLUS BOSON AT 3.7 GeV/c
W. R. Butler, D. G. Coyne, G. Goldhaber, B. H. Hall, J. N. Mac Naughton et al Jun. 1968 12 p refs Presented at the Intern. Conf. on Elementary Particles, Lund, Sweden
(Contract W-7405-eng-48)
(UCRL-19225; CONF-690608-4) Avail: CFSTI

In a high-statistics experiment with positive pion proton at 3.7 GeV/c using a hydrogen bubble chamber the suppression of the reaction positive pion + proton yields Delta (++) + phi meson relative to the reaction positive pion + proton yields Delta (++) + omega meson is found. A cross section ratio of 0.0015 + 0.0023 or − 0.0015 is obtained. However, the positive kaon negative kaon spectrum indicating phi meson production gives no indication that phi meson production occurs in association with Delta(++). The reaction positive pion + proton yields positive pion + phi meson + proton appears to be a nonperipheral process leading to three particles in the final state. The omega meson phi meson mixing angle is also obtained. Also in this experiment the reactions positive pion + proton yields Delta (++) + eta meson and positive pion + proton yields Delta (++) + eta' meson are studied. The ratio of Delta (++) eta meson events to Delta (++) eta' meson is found to be 4.7 + or − 1.3, and the eta meson/eta' meson mixing angle is evaluated. NSA

N70-11984# Eidgenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).
CONTROL OF PERSONNEL NEUTRON DOSES BY COUNTING OF FISSION-FRAGMENT TRACKS IN CERTAIN PLASTICS [CONTROLE DES DOSES NEUTRONIQUES DU PERSONNEL PAR LE COMPTAGE DES TRACES DE FRAGMENTS DE DE FISSION DANS CERTAINS PLASTIQUES]
S. B. Pretre Apr. 1969 18 p refs In FRENCH Presented at Intern. Meeting for the Study of Charged Particle Tracks in Solid and Thin Appl., Clermount-Ferrand, France, 6-9 May 1969
(EIR-152; Conf-690522-1) Avail: AEC Depository Libraries

A neutron dosimeter is described which is now worn by the personnal at the nuclear center of Wurenlingen and which permits the measurement of routine doses as well as possible accidental doses. It contains two detectors each composed of a disk of fissile metal adjacent to a plastic (lexan) disk. The metal is one part Th-232 for the detection of fast neutrons and the other part an Al-U-235 alloy for the detection of thermal neutrons. Certain fission fragments penetrate the plastic disks and leave tracks there which are revealed in a solution of KOH then counted at the microscope. The neutron doses are directly proportional to the trac densities. Author (NSA)

N70-11989# Uppsala Univ. (Sweden). Inst. of Physics.
NUCLEAR SPINS OF NEUTRON-DEFICIENT HOLMIUM AND ERBIUM ISOTOPES
C. Ekstroem, T. Noreland, M. Olsmats, and B. Wannberg Jun. 1969 37 p refs
(UUIP-648) Avail: AEC Depository Libraries

The atomic-beam magnetic-resonance method was used to measure the nuclear spins of some neutron-deficient holmium and erbium isotopes with the following results for Ho (mass number, halflife, spin): (154, 12m, 1), (155, 50m, 5/2), (156, 55m, 1), (157, 14m, 7/2), (158, 11m, 5), (158(m), 29m, 2), (159, 33m, 7/2), (160, 26m, 5), (160(m), 5.0h, 2), (162, 15m, 1), (162(m), 68m, 6), (164, 29m, 1), (164(m), 38m, 6), and for Er: (157, 20m, 3/2), (158, 2.3h, 0), (159, 36m, 3/2), (161, 3.2h, 3/2). The investigated nuclei are located in a region of nuclear deformation, and the nuclear spins were interpreted in terms of the unified nuclear model. Author (NSA)

N70-11991# Akademiya Nauk URSR, Kiev. Inst. for Theoretical Physics.
SUPER-HEAVY PARTICLES IN SCALAR-TENSOR THEORY OF GRAVITATION
K. A. Bronnikov and V. N. Melnikov 1969 17 p refs Presented at 3rd Conf. Axiomatical Field Theory and Theory Elementary Particles, Kiev, Apr. 1969
(ITF-69-21; CONF-690417-4) Avail: AEC Depository Libraries

A self-consistent treatment of a system of the material scalar field and the gravitational field is carried out. The latter is described by means of metric tensor and fundamental scalar field. Solutions are found in the form of Einstein static microuniverses of Stanukovich's plankeon, or Markov's maximon type. It is shown that for a quantum scalar particle to be closed in its own gravitational field it must possess energy not less than 7.5 × 0.00001 dγ. Its dimensions are in this case of the order of Plank length 10 to the minus 33rd power cm. Time-dependent perturbations are considered up to the second order. In the first order they appear as harmonic oscillations with three frequencies; in the second order their amplitude may grow linearly. Author (NSA)

N70-12013# Syracuse Univ., N.Y. Dept. of Physics.
APPLICATION OF RELATIVISTIC RESONANCE FORMULA TO THE POSITIVE ELECTRON NEGATIVE ELECTRON YIELDS POSITIVE PION NEGATIVE PION EXPERIMENT
Michael Parkinson May 1969 17 p refs Sponsored by AEC
(SU-1206-193; NYO-3399-193) Avail: CFSTI

The present data for the reaction positive electron negative electron yields positive pion negative pion is analyzed with the aid of a general effective range resonance formula for the rho meson. It is concluded that: (a) m sub rho equals 769 + or − 5 MeV and Gamma sub rho equals 109 + or − 10 MeV provide a resonable explanation of the present experimental points. (b) The full width at half maximum regardless of the peak height should give an excellent estimate of the rho width. (c) It is hard to escape (F sub pi (m sub rho) squared) squared equals (m sub rho/Gamma sub rho) squared. (d) The effects of final state interactions on resonance shape ought to be investigated. Author (NSA)

N70-12015# California Univ., Berkeley. Lawrence Radiation Lab.
A TEST OF THE DELTA S EQUALS DELTA Q RULE IN LEPTONIC DECAYS OF NEUTRAL K MESONS
Bryan Ronald Webber (Ph.D. Thesis) 10 May 1969 78 p refs
(Contract W-7405-eng-48)
(UCRL-19226) Avail: CFSTI

In 1.3 million hydrogen bubble chamber pictures, taken during an exposure of the 25-inch Lawrence Radiation Laboratory chamber to a 400 MeV/c negative kaon beam, about 18,000 reactions of the type negative kaon proton yields neutral antikaon neutron followed by a visible decay of the neutral K meson were found. After applying many selection criteria, 252 events are found in which the decay is leptonic or radative: neutral kaon yields pion (+ or −) electron (+ or −) neutrino, pion (+ or −) muon (+ or −) neutrino, or pion (+) pion (−) gamma. An electron was identified in 81 of these events, and a muon in 38 of them. The remaining 133 events are treated as completely ambiguous between the leptonic and radative decay hypotheses. By studying the time distributions of the identified and the ambiguous events, the increment S equals increment Q selection rule is tested and also the Sachs model of CP violation, which predicts a large CP-violating increment S equals minus increment Q term in the leptonic decay amplitudes. Parameters, x are defined for the electronic decay

distributions and x' for the muonic, that are real if CP is conserved in the leptonic decays and are zero if increment S equals increment Q. Author (NSA)

N70-12033# Purdue Univ., Lafayette, Ind. Dept. of Physics.
PURDUE UNIVERSITY, DEPARTMENT OF PHYSICS, TASK B Annual Progress Report, 1 Jun. 1968 – 31 May 1969
May 1969 28 p refs
(Contract AT(11-1)-1428)
(COO-1428-133) Avail: CFSTI

Theoretical research on high energy physics at Purdue University is summarized. This research includes particle interactions and production, resonances, particle decay, and scattering. Author (NSA)

N70-12034# Minnesota Univ., Minneapolis. Dept. of Chemistry.
DESIGN OF A ION ENERGY ELECTRON IMPACT SPECTROMETER
Adrian Swanson and Sanford Lipsky 1 Mar. 1969 33 p
(Contract AT(11-1)-913)
(COO-913-32) Avail: CFSTI

A spectrometer used to identify low lying triplet states of polyatomic molecules and to study the threshold behavior of their scattering cross sections is described. The physical phenomenon observed is the energy loss suffered by a nearly monoenergetic beam of electrons incident on a static target gas. The target gas is confined to a small scattering chamber at the center of the spectrometer into which the incident beam is projected. Two electron energy analyzers are mounted adjacent to the scattering chamber and have their entrance apertures oriented at 0 degrees and 90 degrees with respect to the incident beam. The entire spectrometer is housed in a mercury pumped, cold trapped, bakeable, ultra-high vacuum chamber. Internal radiant heaters maintain uniform spectrometer and scattering chamber temperatures up to about 150 degrees centigrade during operation. Author (NSA)

N70-12039# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
SPIN EFFECTS IN THE ELASTIC SCATTERING OF MESONS AND NUCLEONS BY DEUTERONS AT SMALL MOMENTUM TRANSFERS
Ch. Tseren 1969 10 p refs In RUSSIAN
(JINR-P2-4272) Avail: AEC Depository Libraries

Spin effects in the elastic scattering of mesons and nucleons by deuterons at small momentum transfers are considered. The amplitudes of free Npion(NN) scattering are presented, and it is assumed that A sub n = A sub p. The corrections of Wilkin and the t-dependence phases of the pionN(NN) amplitude and a contribution of the square of the spin flip amplitudes are neglected in view of their smallness in the region of the dip. An expression for the (dsigma/dt)pion d is obtained. In the case when a sub n = beta sub n a similar expression is obtained for dsigma/dt. In such an approximation the introduction of spin variables in the differential cross section does not explain the discrepancy between the theory and the experimental data. Further it is probably necessary to take into account the multiple scattering at least triple scattering, as their contribution may be appreciable in t sub o. Author (NSA)

N70-12041# Mound Lab., Miamisburg, Ohio.
GAMMA COUNTING OF POLONIUM-210 IN SOLUTION
C. T. Bishop, M. L. Curtis, and M. M. Bolton 12 Aug. 1969 7 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1654) Avail: CFSTI

Polonium-210 was assayed in solution by counting its 0.803-MeV gamma rays with a sodium iodide crystal and multichannel analyzer. Absolute activities were obtained by comparison with a calorimetered standard. Samples with polonium concentrations between 0.1 mCi/ml and 10 Ci/ml can be rapidly assayed with an accuracy of about 1.5% by counting after dilution to a fixed volume. Author (NSA)

N70-12044# Oregon Univ., Eugene.
THE 7416-KEV 2(+) LEVEL IN SILICON-28 AND AN EXCITED PROLATE ROTATIONAL BAND
E. F. Gibson, A. Goswami, F. Huang, and D. K. Mc Daniels [1969] 9 p refs Sponsored by AEC
(RUO-1925-25) Avail: CFSTI

Gamma coincidence measurements revealed decay modes of the 7416-keV 2(+) level in Si-28 to the 0(+) level at 4975 keV (3.7 + or - 2.0%) and to the 2(+) level at 1779 keV (2.1 + or - 0.6%). The existence of an excited prolate rotational band in Si-28 based on either the 4975 or 6691 keV 0(+) states with the 7416 keV level as the 2(+) member was ruled out on the basis of lifetime and branching ratio data. Author (NSA)

N70-12045# California Univ., Berkeley. Lawrence Radiation Lab.
FURTHER STUDY OF THE H(990) EFFECT
G. Goldhaber, W. R. Butler, D. G. Coyne, B. H. Hall, J. N. Mac Naughton et al Jun. 1969 15 p refs Presented at the Intern. Conf. on Elementary Particles, Lund, Sweden
(Contract W-7405-eng-48)
(UCRL-19229; CONF-690608-5) Avail: CFSTI

An exposure of 180,000 pictures of the hydrogen bubble chamber to a 3.7 GeV/c pion(+) beam was made. It is found that in a sample of 17,082 pion(+) + proton yields pion(+) + pion' + pion(0) + pion(+) + proton events without rho meson selection and after allowing for the eta' meson yields pion pion gamma decay mode there is a small but distinct residual effect called h(1000). Also the h(1000) effect shows up clearly primarily outside of the Delta (++) band. To interpret the observed effect a quantitative comparison is made between eta' meson production and the H effect. It is noted that the H(990) effect is not observed. NSA

N70-12046# Johnston Labs., Inc., Cockeysville, Md.
BASIC DEVELOPMENT AND APPLICATIONS OF BUBBLE CHAMBERS FOR LOW LEVEL COUNTING Final Report
C. P. Petroff, W. S. Koski, and J. R. Waters 31 Jan. 1969 104 p refs
(Contract AT(30-1)-3506)
(JLI-3506-41) Avail: CFSTI

It is shown that a heavy liquid bubble chamber can be used as a detector of low level radioactivity with properties comparable to or better than currently existing low level counting systems. Initial work on a simple manually controlled system using Freon 13B1 and propane as chamber fluids demonstrated proof of principle. Propane was then used in an automatically operating system in chambers of glass and quartz of 5 to 15 ml volume. The chamber operated at 55 deg C. After expansion, so that the propane became superheated, the time delay to boiling was measured and recorded. Boiling was sensed by the sudden rise in pressure actuating a strain gauge pressure transducer; the tracks were not photographed. It was found that three plateaus existed in the plot of chamber counting rate against the superheat pressure (difference between vapor pressure at 55 deg C and pressure to which chamber was expanded). Author (NSA)

N70-12049# Uppsala Univ. (Sweden). Inst. of Physics.
LIFETIMES OF EXCITED STATES OF Ir-193
J. Lindskog, K-G. Vaelivaara, Z. Awwad, S-E. Haegglund, A. Marelius et al Jul. 1969 14 p refs
(UUIP-650) Avail: AEC Depository Libraries

The lifetimes of four excited states in IR-193 were measured by a delayed coincidence technique. The following results were

obtained: 73.0-keV level: T sub 1/2 = 6.3 ± 0.2 ns, 138.9-keV level: T sub 1/2 = 74 ± 11 ps, 180.0-keV level: T sub 1/2 = 80 + or - 30 ps, 460.5-keV level: T sub 1/2 = 14 + or - 9 ps. Furthermore upper limits of the lifetimes of the doublet 557-559 keV were shown to be 557.3-keV level: T sub 1/2 less than or equal to 50 ps, 559.2-keV level: T sub 1/2 less than or equal to 200 ps. A comparison was made between experimental and theoretical M1-transition probabilities for the transitions deexciting the 138.9- and 180.0-keV levels. Author (NSA)

N70-12069# Australian National Univ., Canberra. Research School of Physical Sciences.
PROTON INDUCED REACTIONS IN O-18 FROM 3.00 TO 7.00 MeV
G. U. Din [1969] 20 p refs
(ANU-P/448) Avail: CFSTI

Excitation functions for the O-18 (p,p' gamma), O-18 (p, alpha' gamma) N-15 and O-18 (p,n' gamma F-18 reactions were measured by observing simultaneously yields of 0.940, 1.045, 1.080, 1.98 and 5.30 MeV gamma rays from the decay of the excited states of the final nuclei as a function of proton energy from 3.00 to 7.00 MeV. The yield curves show resonances corresponding to energy levels in F-19 with excitation energies between 10.8 and 14.3 MeV. Author

N70-12071# California Univ., Riverside.
PARTICLE PHYSICS Annual Report
P. E. Kaus and B. R. Desai Jun. 1969 107 p refs
(Contract AT(11-1)-34)
(UCR-34-P-107-95) Avail: CFSTI

Progress in theoretical high energy physics research at the University of California, Riverside, is reported for the year 1968 to 1969. A publications list is included and complete copies of reprints or preprints of published research work are appended. NSA

N70-12072# California Univ., Berkeley. Lawrence Radiation Lab.
HIGH-ENERGY NEUTRON SPECTROSCOPY WITH ACTIVATION DETECTORS, INCORPORATING NEW METHODS FOR THE ANALYSIS OF GE(LI) GAMMA-RAY SPECTRA AND THE SOLUTION OF FREDHOLM INTEGRAL EQUATIONS
Jorma Tapio Routti (Ph.D. Thesis) Apr. 1969 155 p refs
(Contract W-7405-eng-48)
(UCRL-18514) Avail: CFSTI

The determination of high energy neutron spectrum using activation detectors was studied and developments and extensions in methodology and techniques are reported. The use of high-resolution gamma spectroscopy with Ge(Li) detector systems was incorporated to the measurement of induced activities. A method for the automatic analysis by computer of semiconductor gamma ray spectra is described. The detector systems considered include conventional threshold detectors, Bonner spheres, and recoil spectroscopy with emulsions. Preliminary studies are also made of the use of high-threshold spallation reactions by employing semiconductor gamma spectroscopy in the measurements and a mathematical model for the evaluation of the cross sections. In the determination of the neutron spectrum from measured activities two numerical methods for the solution of the first order Fredholm integral equation are described. Author (NSA)

N70-12076# Central Research Inst. for Physics, Budapest (Hungary).
ANOMALOUS HYPERFINE FIELD AT RECOILED Rh NUCLEI OF LOW ENERGY IN Fe sub 51.5 - Rh sub 48.5 ALLOY
L. Varga, I. Demeter, L. Keszthelyi, I. Pocs, And Z. Szoekefalvi-nagy 1969 7 p refs
(KFKI-3/1969) Avail: AEC Depository Libraries

The rotation angles for the 298- and 362-keV states of Rh 103 were measured after Coulomb excitation with 2.5-MeV protons in Fe Rh alloy in an attempt to determine the g-factors of the two states. The results were interpreted by considering the existence of a transient field at such low energies. Author (NSA)

N70-12081# Case Western Reserve Univ., Cleveland, Ohio.
A RESEARCH PROGRAM IN HIGH ENERGY ACCELERATOR PHYSICS AND LOW LEVEL COUNTING ELEMENTARY PARTICLE PHYSICS Technical Report, 1 Oct. 1968 - 30 Sep. 1969
Thomas L. Jenkins Jun. 1969 8 p refs
(Contract AT(11-1)-1749)
(COO-1749-11) Avail: CFSTI

Research on the neutrino and low level counting, pion ( ) + proton charge exchange scattering at high momentum transfer, and CP asymmetry in the decay Koan (o) sub 2 yields pion(+) + pion ( ) + pion (o) is briefly described. Author (NSA)

N70-12088# California Univ., Riverside.
HIGH-ENERGY EXPERIMENTAL PHYSICS Annual Report
A. Kernan and R. T. Poe May 1969 24 p refs
(Contract AT(11-1)-34)
(UCR-34-P-107-84) Avail: CFSTI

Progress in experimental high-energy physics research at the University of California, Riverside, for the year 1968 to 1969 is reviewed. Papers published during the year are briefly discussed and research in progress is outlined. NSA

N70-12095# Central Research Inst. for Physics, Budapest (Hungary).
MILLISTRONG C VIOLATION AND ETA DECAY
A. Frenkel and G. Marx (Budapest Sci. Univ.) 1969 31 p refs
(KFKI-2/1969) Avail: AEC Depository Libraries

The isospin properties of the (assumed) millistrong C violation were investigated. The consequences of a delta-I = 0 and delta -I = 2 selection rule are discussed for the eta-meson yields pion(+)pion(o)pion(-) and eta-meson yields pion (o)e(+)e( ) decays. If the observed charge asymmetry of the eta-meson yields pion(+)pion(o)pion(-) is realistic, the C violating 3-pion final state is mainly an I = 2 eigenstate, produced by a delta-I = 0 coupling with a constant g sub 2 approximately 0.01. Since the I = 0 eigenstate is here very much suppressed by the centrifugal barrier, the delta-I = 0 coupling may be much stronger, e. g., g sub 0 > 0.1, limited only by the negative results of the eta-meson yields pion(o)e(+)e( ) experiments. So the delta-I = 0 dominance of the millistrong C violation, suggested by the indication epsilon absolute value > > epsilon prime absolute value in the K(0) decays, is by no means in contradiction with the observed delta-I = 2 character of the eta-meson yields pion(+)pion(o)pion( ) asymmetry. NSA

N70-12113# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
WHAT ARE RANGE AND TIME OF HIGH-ENERGY INTERACTION OF PARTICLES?
A. I. Lendel, Yu. M. Lomsadze, S. S. Tokar, and V. V. Chizhikov 1969 11 p refs Translated into ENGLISH from Conf. Presented at the Third Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, USSR
(ITF-69-38) Avail: AEC Depository Libraries

It is shown that in the expression for the amplitude of bremsstrahlung of arbitrary number of soft photons through the main-reaction amplitude the first derivatives of this amplitude with respect to mass of scattering particles are absent for any relation between the energies of photons. A new method is proposed for obtaining experimental information about the effective space-time regions sigma(1) (s) and Phi (0) (s) of the particle interaction at high energies. The method is based on experimental studying of

the ratio d sigma sub gamma/d sigma of the differential cross section of the bremsstrahlung reaction to the differential cross section of the main reaction at large s in a certain region of the variation of t. Author (NSA)

N70-12114# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

ON THE INFLUENCE OF THE UNCORRELATED PION PION INTERACTION ON NN-SCATTERING

V. I. Lendel, E. V. Tovtin, and B. M. Ernst 1969 11 p refs In RUSSIAN Presented at the 3d Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1969

(ITF-69-35; CONF-690417-8) Avail: AEC Depository Libraries

The results of the calculations of NN-partial waves with isotopic spin value I = 1 in one-boson-exchange model with the inclusion of uncorrelated pion-pion interaction according to I are given. It turns out that the pure OBE model gives a somewhat better agreement of theory with experiment. Nevertheless the final solution to the problem of importance of the uncorrelated pion-pion interaction in question may be reached only after simultaneous consideration of the other strong interactions. Author (NSA)

N70-12116# Purdue Univ., Lafayette, Ind.

EXPERIMENTAL RESEARCH ON HIGH-ENERGY PHYSICS Annual Progress Report, 1 Jun. 1968 - 31 May 1969

Frank J. Loeffler 31 May 1969 27 p refs

(Contract AT(11-1)-1428)

(COO-1428-127) Avail: CFSTI

Experimental research on high-energy physics at Purdue University is summarized. This research includes Kaon ( ) + d, pi(+) + p, pi(+) + d, pi( ) + p interactions, and the pipi phase shift analysis. A list of publications and papers in process is appended. NSA

N70-12158# Institute of Physical and Chemical Research, Saitama (Japan).

IPCR CYCLOTRON, VOLUME 2 Progress Report, 1968

1968 179 p refs

Avail: CFSTI

CONTENTS:

1. MACHINE OPERATION p 2-6 (See N70-12157 02-22)

2. MACHINE DEVELOPMENT p 7-18 refs (See N70-12158 02-22)

3. ACCELERATOR PHYSICS p 19-35 refs (See N70-12159 02-24)

4. NUCLEAR PHYSICS: SCATTERING AND REACTION p 36-97 refs (See N70-12160 02-24)

5. NUCLEAR PHYSICS: NUCLEAR SPECTROSCOPY AND ITS APPLICATIONS p 98-111 refs (See N70-12161 02-24)

6. NUCLEAR INSTRUMENTATION AND TECHNIQUES p 112-120 refs (See N70-12162 02-22)

7. RADIOCHEMISTRY p 121-133 refs (See N70-12163 02-14)

8. RADIATION CHEMISTRY AND RADIATION BIOLOGY p 134-144 refs (See N70-12164 02-24)

9. SOLID STATE PHYSICS p 145-155 refs (See N70-12165 02-22)

10. RI PRODUCTION AND ITS APPLICATIONS p 156-162 refs (See N70-12166 02-24)

11. RADIATION MONITORING p 163-169 refs (See N70-12167 02-22)

N70-12159# Institute of Physical and Chemical Research, Saitama (Japan).

ACCELERATOR PHYSICS

In its IPCR Cyclotron, Vol. 2 1968 p 19-35 refs (See N70-12158 02-24)

Avail: CFSTI

During the reporting period, major efforts were devoted to acceleration of multicharged heavy ions; experimental results were recorded for proton acceleration at energies of 7.2 MeV at the maximum radius. Data on the type of ions that can be extracted and their energy regions are included, as well as identification of ions which could be accelerated to the maximum radius, but could not be extracted from the cyclotron. It is reported that the accelerating chamber must be kept at high vacuum as much as possible, since a higher dee voltage must be applied for accelerating multicharged heavy ions than for that of p, d, and alpha beams; the charge exchange of the beam must also be reduced. A short discussion is presented regarding energy reproducibility in magnetic analyzers. In addition, a method for estimating ion energy by radio frequency analysis is treated that is accurate within an error of 2% under normal operation. A.C.R.

N70-12160# Institute of Physical and Chemical Research, Saitama (Japan).

NUCLEAR PHYSICS: SCATTERING AND REACTION

In its IPCR Cyclotron, Vol. 2 1968 p 36-97 refs (See N70-12158 02-24) Avail: CFSTI

A general survey and some conclusions drawn from other investigations of elastic scattering of He-3 from nuclei is presented, and an optical model analysis technique is described. Experiments involving elastic and inelastic scattering of heavy ions are reported, from which differential cross sections of 84-MeV N-14 particles and 73-MeV C-12 particles were measured to study the reaction mechanisms between complex nuclei at energies above the coulomb barrier. Aluminum and silicon targets were bombarded by He-3 ions at 22.34 MeV and 570 microgram/sq cm. The spectroscopic characteristics of both reactions are graphically depicted. Angular distributions are also given for the (d,d), (d, d'), and (d,t) reactions of Al-27 and Si-28. Results of inelastic scattering of protons for Zr-91 nuclei are included, as well as those for a two-nucleon transfer reaction involving C-12(He-3,p) N-14 and Al-27(He-3,p)Si-29. Finally, measurements of double scattering of He-3 from carbon are reported, followed by descriptions of a two-nucleon transfer reaction code and an automatic search code for use with an established nuclear optical model. A.C.R.

N70-12161# Institute of Physical and Chemical Research, Saitama (Japan).

NUCLEAR PHYSICS: NUCLEAR SPECTROSCOPY AND ITS APPLICATIONS

In its IPCR Cyclotron, Vol. 2 1968 p 98-111 refs (See N70-12158 02-24)

Avail: CFSTI

Excitation levels in xenon isotopes were studied using in-beam spectroscopy. This is one of the best techniques for analyzing energy systematics, since the nucleus de-exites after the formation of the compound nucleus and evaporation of a few neutrons, mainly through gamma ray emission. The examinations were concentrated on neutron-deficient nuclei using heavy ion reactions and on measuring isomer lifetimes by taking advantage of the bunched character of the accelerated ions in the cyclotron. Other experiments were conducted on decay properties of the strongly deformed odd nucleus, Lu-171, using beta and gamma spectroscopic techniques. The conversion electron spectra freom Eu-151 in the decay of Gd-151 were measured by a high resolution, air-core beta spectrometer. Additional studies are in progress regarding the decay characteristics of Zr-87, as well as the potential effectiveness of gamma ray spectroscopy in nuclide analysis. A.C.R.

N70-12164# Institute of Physical and Chemical Research, Saitama (Japan).
RADIATION CHEMISTRY AND RADIATION BIOLOGY
In its IPCR Cyclotron, Vol. 2 1968 p 134-144 refs (See N70-12156 02-24)
Avail: CFSTI

The Fricke dosimeter, which uses an aqueous, ferrous sulfate solution, was applied to experiments in dose determination of cyclotron beams. Particular investigations were conducted to determine the oxidation yield of the dosimeter for several kinds of particles with various values of linear energy transfer (LET). Gamma radiolysis of methanol and tetrahydrofuran was also performed to determine effects of intermediate LET on the yield of solvated electrons, in addition to an evaluation of LET effects on biological cells. A.C.R.

N70-12166# Institute of Physical and Chemical Research, Saitama (Japan).
RI PRODUCTION AND ITS APPLICATIONS
In its IPCR Cyclotron, Vol. 2 1968 p 156-162 refs (See N70-12156 02-24)
Avail: CFSTI

Three methods are identified for preparing F-18 labeled compounds by bombardment of an oxygen stream: (1) elution of the absorbed F-18, often with a simultaneous isotopic exchange; (2) halogen-interchange reaction; and (3) the Schiemann reaction. Preparation of Fe-52, an isotopic tracer used in medical studies, is reported by the Cr-50(alpha,2n)Fe-52 reaction. Separation of carrier-free Bi-206 from Pb-206 was also achieved by bombarding the lead target with 19-MeV deuteron particles. A.C.R.

N70-12168# California Univ., Livermore. Lawrence Radiation Lab.
NEUTRON-CAPTURE GAMMA-RAY STUDIES OF CALCIUM ISOTOPES WITH A Ge(Li)- Ge(Li)- NaI(Tl) COINCIDENCE SPECTROMETER SYSTEM
D. H. White and R. E. Birkett 28 Apr. 1969 28 p refs Presented at the Intern. Symp. on Neutron Capture Gamma-Ray Spectry., Studsvik, Swed., 11-15 Aug. 1969 Submitted for publication
(UCRL-71676; CONF-690802-1) Avail: CFSTI

A three-parameter spectrometer system is described, consisting of two Ge(Li) NaI(Tl) gamma-ray spectrometers, one designed for high-energy and one for low-energy neutron-capture gamma-rays. These systems may be operated in various modes, both singly and in coincidence. Data were taken with certain calcium isotopes, and the methods of the data analysis are given. A method is described to show how tentative transitions are fit to the proposed level scheme by a linear least-squares program. Results are presented for Ca-44. Author (NSA)

N70-12169# California Univ., Livermore. Lawrence Radiation Lab.
COMPUTER CONTROLLED DATA ACQUISITION AND ISOTOPIC RATIO MEASUREMENTS IN REAL TIME
C. A. Bailey, R. L. Peterson, P. D. Siemens, and R. J. Dupzyk 6 Jun. 1969 5 p Presented at 17th Ann. Conf. on Mass Spectrometry and Allied Topics, Dallas, 18-23 May 1969 Submitted for publication
(UCRL-71520; CONF-690523-1) Avail: CFSTI

A computer program written on a 4K PDP-8 for on-line data acquisition from a multistage mass spectrometer is described. This system includes real time data acquisition, display, and data reduction. Data are obtained by pulse counting techniques (20 nanosecond double pulse resolution) with the computer providing multisumming scaling over 256 channels. A keyboard monitor provides the operator with complete control of the system. By typing control characters on the teletype various operations occur, such as: calling for real time data acquisition; storage of data on DECtape (magnetic tape); real time data display (log or linear); finding peaks in the spectrum; calculating atom ratios; or printing data on the teletype. By using program interrupt techniques several of these operations appear to go on at the same time. Author (NSA)

N70-12173# International Centre for Theoretical Physics, Trieste (Italy).
REGGE TRAJECTORIES WITH LEFT-HAND BRANCH LINES
Reinhard Oehme Sep. 1969 9 p refs Submitted for publication
(IC-69-119) Avail: CFSTI

The conditions are explored under which Regge trajectories can have left-hand branch lines without two or more crossing pole surfaces appearing in the physical sheet of the continued partial-wave amplitude. Author (ESRO)

N70-12181# Chicago Univ., Ill. Dept. of Physics.
FORWARD DISPERSION RELATIONS AND MICROCAUSALITY
Reinhard Oehme Apr. 1969 44 p refs Submitted for publication
(Contract AT(11-1)-264)
(EFI-69-49; COO-264-498) Avail: CFSTI

A brief review is given of the structure of forward dispersion relations and of their derivation on the basis of microcausality, spectral conditions, and other basic notions of relativistic field theory. After a short discussion of the global aspects of local commutativity, the effects of possible violations of microcausality are studied. Modified dispersion formulas are derived under the assumption of exponentially decreasing bounds for the matrix elements of commutators in space-like directions. Simple mathematical models are considered in order to study qualitatively the implications of possible acausal singularities. Author (NSA)

N70-12183# Chicago Univ., Ill. Dept of Physics.
SPIN-1 ELECTRODYNAMICS WITH AN ELECTRIC QUADRUPOLE MOMENT
Harmon Aronson (Ph.D. Thesis) Apr. 1969 34 p refs
(Contract AT(11-1)-264)
(EFI-69-31; COO-264-490) Avail: CFSTI

The quantum theory of the electromagnetic interactions of a charged, spin-1 particle is investigated within the framework of canonical field theory. An earlier treatment of this problem by Lee and Yang is generalized so as to include an arbitrary quadrupole moment. Some difficulites connected with the lack of relativistic covariance of the theory can be overcome, without using Lee and Yang's xi-limiting formalism, provided one allows for direct scattering among the charged particles. Author (NSA)

N70-12188# European Space Research Inst., Frascati (Italy).
A COMMENT ON THE L sub II, L sub III EDGE ANOMALY OF SODIUM REPORTED BY HAENSEL ET AL
J. P. Connerade Sep. 1969 3 p refs Submitted for publication
(ESRIN-IN-53) Avail: CFSTI

A comparison is made between the L sub II, L sub III edge structure in solid sodium observed by Haensel et al. and the doublet structure in sodium vapour from which it is concluded that the core electrons occupy similar states in the solid and in the atomic vapour. Author (ESRO)

N70-12186# Junta de Energia Nuclear, Madrid (Spain).
CONCENTRATION AND SOLIDIFICATION OF LIQUID RADIOACTIVE WASTES: LABORATORY STUDIES [CONCENTRACION E INMOVILIZACION DE RESIDUOS LIQUIDOS RADIACTIVOS: ESTUDIOS DE LABORATORIO]
F. Nuche Vazquez and F. de Lora Soria 1969 21 p refs In SPANISH; ENGLISH summary
(JEN-204-DMa/I-24) Avail: CFSTI

Bench scale runs on concentration of intermediate level radioactive wastes, and incorporation of the concentrates in asphalt, are described. The feasibility of the process has been demonstrated, with a maximum incorporation of 60 per cent of salts into the asphaltic matrix and a volume reduction factor of 10. Author (ESRO)

N70-12198# International Centre for Theoretical Physics, Trieste (Italy).

LORENTZ POLES AT ZERO ENERGY IN THE UNEQUAL-MASS SCATTERING AMPLITUDE

K. Toth Aug. 1969 16 p refs Submitted for publication
(IC/69/104) Avail: CFSTI

An expansion of the scattering amplitude is given with respect to Lorentz representations. It turns out that an infinite number of Lorentz poles must exist for which J sub 0 + sigma, the sum of the Lorentz quantum numbers is fixed. Author (ESRO)

N70-12199# International Centre for Theoretical Physics, Trieste (Italy).

EFFECTIVE LAGRANGIAN FOR NON-LEPTONIC HYPERON DECAYS WITH SU(3) × SU(3) SYMMETRY BREAKING

K. Ahmed (Islamabad Univ.), G. Murtaza (Islamabad Univ.), and A. M. Harun-Ar Rashid (Islamabad Univ.) Sep. 1969 11 p refs Submitted for publication
(IC/69/111) Avail: CFSTI

The hadronic decays of hyperons are discussed in the context of broken chiral symmetry, the breaking being introduced according to the prescription of Gell-Mann, Oakes and Renner. The corrections due to symmetry breaking lead to contributions to the p-wave amplitudes giving better agreement with the experimental data whereas the s-wave amplitudes remain almost unchanged. Author (ESRO)

N70-12207*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RADIOFREQUENCY SYSTEM ANALYSIS OF THE LEWIS CYCLOTRON MODIFICATION

Theodore E. Fessler Washington Dec. 1969 30 p refs
(NASA-TN-D-5546) Avail: CFSTI CSCL 09C

The resonant cavity of the modified Lewis Research Center cyclotron is analyzed. The results include the variation of resonant frequency with tuning panel position, an estimate of the skin resistance losses, the distribution of voltage along the length of the dee electrode, and a lumped-impedance equivalent circuit. Dee-to-dee coupling is analyzed for its influence on servotuning of the dees. A tuning function is presented which should make stable servotuning possible for any amount of dee-to-dee coupling. The performance of a shortened coupling line between the power amplifier and the dee stem is also analyzed. Author

N70-12216*# Gulf General Atomic, San Diego, Calif.

REEVALUATION AND ANALYSIS OF NEUTRON SPECTRA IN LIQUID HYDROGEN Final Report

G. D. Trimble and W. E. Selph 4 Aug. 1969 283 p refs
(Contract NAS3-11228)
(NASA-CR-72598; GA-9480) Avail: CFSTI CSCL 20H

Angular neutron spectra were measured from 15 MeV to 0.0005 eV at various angles for liquid hydrogen thicknesses of 2.5, 4.5, 7.0, 10.5, and 13.0-in. Since considerable time had elapsed between the two contracts, it was felt desirable to reevaluate and update all the spectral data in a consistent manner using the latest available techniques. This report describes those methods and techniques used to reevaluate and update all the spectral data generated under the above mentioned contracts. Calculations were performed using Monte Carlo and discrete ordinates codes for comparison with selected spectral measurements. The reevaluated and updated spectral data and calculations are tabulated. Author

N70-12224# Groupe de Recherches Ionospheriques, Issy-les-Moulineaux (France).

PHASE CORRELATION STUDY ON SYNCHROTRON RADIATION [ETUDE DES CORRELATIONS DE PHASE EXISTANT DANS LE RAYONNEMENT SYNCHROTRON]

K. Hagege Dec. 1967 62 p refs In FRENCH
(GRI-NT-72) Avail: CFSTI

In 1959 Jennison noted a correlation while measuring extraterrestrial radio emissions at 127 MHz and 254 MHz in type II solar bursts with an interferometer. This correlation was not found in other radio sources or during quiet sun periods. Experiments have been carried out to check it. Synchrotron radiation could explain the results of Jennison's experiment. The synchrotron radiation process is briefly considered and the statistical distribution of the radiation analyzed. The response of a Jennison type device to incoming radiation is discussed for both infinite and limited observation time. A spectral analysis of the output signal is carried out and it is shown that in some conditions phase correlation might occur but it is not proved that the correlation obtained in the Jennison-type measurement was, in fact, due to synchrotron radiation. ESRO

N70-12228# International Centre for Theoretical Physics, Trieste (Italy).

FOUNDATIONS FOR ELEMENTARY PARTICLE UNITARY SYMMETRY IN FIRST PRINCIPLES OF GENERAL RELATIVITY

E. J. Schremp Aug. 1969 39 p refs Submitted for publication
(IC-69-89) Avail: CFSTI

Three mutually related key ideas are considered with the objective of establishing a mutual compatibility among all three. The first idea is concerned with the possibility of generalizing the Riemannian metric of space time; and it takes cognizance of a fundamental issue as to whether the desired generalization should assume one or another of two alternative forms, characterized by metric tensors which are, respectively, (i) Hermitian, or (ii) real but not symmetric . The second idea takes cognizance of certain phenomenological symmetry laws which govern elementary particle strong interactions; and it leads to the inference, but not yet to a conclusive proof, that the above mentioned fundamental issue must be decided in favor of alternative (i). The third idea takes cognizance of a certain purely formal theorem, stated at the outset of this paper; and it leads to a proof that alternative (i) is compatible, and alternative (ii) is incompatible, with certain consequences of this theorem. In considering together these three key ideas, it is necessary to formulate a certain new and unique set of first principles of general relativity, based upon the introduction of a fundamental Hermitian metric tensor. It is then shown that these generalized first principles are capable, in particular, of serving as relativistic foundations for elementary particle unitary symmetry, the groups of transformations in the elementary particle 'internal' variables (isospin and hypercharge) being automatically built into the resulting underlying geometrical substrate in space time. Conversely, it is also found that these new first principles provide what appears to be a final solution of the long-standing problem of finding an ultimate generalization of the Riemannian metrical structure of space time. Author (ESRO)

N70-12235# International Centre for Theoretical Physics, Trieste (Italy).

REALIZATIONS OF LIE ALGEBRAS WITH PARAFIELD OPERATORS

K. Kademova Sep. 1969 9 p refs Submitted for publication
(IC-69-108) Avail: CFSTI

A realization of any Lie algebra is given in terms of second-order polynomials of Green algebra generators. An example of realization of some class of representations of the Lie algebra in a suitably chosen linear space is also given. Author (ESRO)

N70-12268# Commissariat à l'Energie Atomique, Bruyères-le-Chatel (France).
APPLICATION OF MERCURY CATHODE ELECTROLYSIS TO FISSION PRODUCT SEPARATION [APPLICATION DE L'ELECTROLYSE SUR CATHODE DE MERCURE A LA SEPARATION DES PRODUITS DE FISSION]
André Besson, Yvon Prigent, and Francis Van-Kote Aug. 1969 23 p refs In FRENCH; ENGLISH summary
(CEA-R-3788) Avail: CFSTI

A method involving controlled potential mercury cathode electrolysis has been developed to separate fission products. It allows the radiochemical determination of Ag, Cd, Pd, Rh, Ru, Sn, Te, Sb and Mo from solutions of fission products highly concentrated in mineral salts. The general procedure consists of three main steps: electrolytic amalgation, destruction of amalgams and ultimate purification of elements by other means. Electrolytic operations last about five hours. Chemical yields lie between 10 percent and 70 percent. Author (ESRO)

N70-12277# Franklin Inst., Philadelphia, Pa. Research Labs.
DEFECT STRUCTURE OF IONIC MATERIALS BY ELECTRON PARAMAGNETIC RESONANCE AND NUCLEAR MAGNETIC RESONANCE Final Scientific Report
A. Neaves and G. A. Tint Wright-Patterson AFB, Ohio ARL May 1969 113 p refs
(Contract AF 33(615)-3594)
(AD-692741; ARL-69-0071) Avail: CFSTI CSCL 20/2

Electron spin resonance techniques were used on two systems, yttria and thoria, which were thermoluminescent under U. V. irradiation. In the case of a very pure ThO2 crystal, it was possible to identify the electron and hole traps which empty or fill in a particular temperature and give rise to the thermoluminescence. Possible thermoluminescent centers are discussed. Author (TAB)

N70-12280# Australian National Univ., Canberra. Research School of Physical Sciences.
THE 1080 keV RESONANCE OF THE N-15(PROTON, ALPHA GAMMA) REACTION
S. D. Cloud and T. R. Ophel [1969] 12 p refs
(ANU-P/458) Avail: CFSTI

The spins of levels in O-16 excited by the N-15(p,alpha sub 1 gamma) reaction for proton energies between 898 and 1640 keV have been derived from measurements with a Ge(Li) detector. Angular correlations, extracted from the Doppler-broadened profiles measured at each resonance, confirm that the spins of the 898, 1210 and 1640 keV resonances are 2( ), 3( ) and 1(+) respectively and enable an assignment of 1( ) to the weak, broad resonance at approximately 1080 keV. Author

N70-12285# Junta de Energia Nuclear, Madrid (Spain). Metallurgy Dept.
INFLUENCE OF SILICON CONTENT ON CORE CORROSION PROPERTIES OF DISPERSION TYPE FUEL PLATES [INFLUENCIA DEL CONTENIDO EN SILICIO SOBRE LA CORROSION ACUOSA DE LOS NUCLEOS DE PLACAS COMBUSTIBLES]
C. Calvo, L. Ma. Saenz de Tejada, and J. Diaz Diaz 1969 29 p In SPANISH; ENGLISH summary Submitted for publication
(JEN-205-DMe/I-21) Avail: CFSTI

A new process to produce aluminum base dispersion type fuel plates has been developed at the Spanish JEN (Junta de Energia Nuclear). Various silicon additions have been used in the reactant mixture to avoid any further reaction of the dispersed phase with the aluminum matrix during the plate manufacturing process. In this report the corrosion resistance of the plate core as fabricated is studied as a function of the silicon content in the dispersed phase. Specimens with a 65% of dispersed material, containing 2, 3 and 5% Si, were exposed to water at 100 C, 150 C and 200 C for various periods of time. The corrosion resistance is strongly influenced by, and increased with, the silicon content. Author (ESRO)

N70-12293# Hamburg Univ. (West Germany).
INVESTIGATION OF DYNAMICALLY POLARIZED HELIUM-3 [UNTERSUCHUNGEN AN DYNAMISCH POLARISIERTEM HELIUM-3]
Rainer Beckmann (Ph.D. Thesis) 1969 59 p refs In GERMAN
Avail: CFSTI

The design of a polarized He-3 target is described which was to be used to measure the reaction He-3 (d,p) He-4 at an incident energy of 2 MeV. The polarization is obtained by means of transferring the polarization of an optically pumped system through electron exchange to a system of higher density. The primary pumped system consists of excited He-3 atoms in a metastable state. The design of the experiment is described and the requirements concerning the magnetic field, helium purity, and the exciting flash lamp are discussed. The target is to be used in cyclotron investigations. ESRO

N70-12295# Washington Univ., Seattle. Dept. of Physics.
QUANTIZATION CONDITIONS FOR LINEAR AND NONLINEAR TRAJECTORIES
Darryl D. Coon 1969 7 p refs
(Contract AT(45-1)-1388)
(RLO-1388-554) Avail: CFSTI

It is shown that the relation between linear trajectories of opposite normality also holds for nonlinear trajectories which occur in a generalization of the Veneziano form. It is also shown that half-integer spacing of trajectories of opposite normality which are connected by pion emission is possible only if the lowest spin particle on the upper trajectory is missing. Experimentally there is a distinct absence of such particles. Author (NSA)

N70-12303# Uppsala Univ. (Sweden). Inst. of Physics.
THE 371 keV 2 PLUS - 2 PLUS TRANSITION Os 190 INVESTIGATED BY ELECTRON-ELECTRON AND GAMMA-ELECTRON DIRECTIONAL CORRELATIONS
L. Samuelsson, R. Vukanovic, M. Migahed, M. Zupancic, L. O. Edvardson et al Mar. 1969 26 p refs
(UUIP-628) Avail: AEC Depository Library

Electron-electron directional correlation measurements were made on the 2(+)(371 keV), 2(+)(187 keV), 0(+) cascade in Os-190. The magnitude of electric monopole to quadrupole mixing ratio for the 371-keV transition was determined to be q(E0/E2) = -0.06(12) for lambda = 1. NSA

N70-12304# Syracuse Univ., N.Y. Dept. of Physics.
NOTE ON THE GAUGE FIELD CHIRAL LAGRANGIAN
J. Schechter and Y. Veda (Iowa State Univ.) May 1969 43 p refs Supported in part by AEC
(NYO-3399-194; SU-1206-194) Avail: CFSTI

The SU(3) × SU(3) chiral Lagrangian with gauge fields is discussed, including a consideration of SU(3) symmetry breaking. In addition to details of the formulation, applications to pion-N scattering lengths, K(+)-N scattering lengths and semi-leptonic decays are treated. The S-wave pion-N scattering lengths are found to be independent of the vector meson dominance assumption. A possible improvement of the calculation by adding the N* particle is also discussed. The K(+)-N S-wave scattering lengths can be calculated in good agreement with experiment when all symmetry breaking is put into the mass terms of the physical particles and it is assumed that the physical phi particle decouples from the nucleons. Alternative SU(3) breaking schemes are investigated and for a modified mass-term mixing model the renormalizations to the Cabibbo theory for all semi-leptonic decays can be correlated in terms of one (known) parameter. Author (NSA)

N70-12307# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

STUDY OF SOME PROPERTIES OF BOUND LEVELS AND VIRTUAL LEVELS EXCITED WITH RESONANCE NEUTRONS [ETUDE DE QUELQUES PROPRIETES DE NIVEAUX LIES ET DE NIVEAUX VIRTUELS EXCITES A L'AIDE DE NEUTRONS DE RESONANCE]

Rex Nazaré Alves (Ph.D. Thesis--Paris Univ., 16 May 1968) Jul. 1969 404 p refs In FRENCH; ENGLISH summary

(CEA-R-3602) Avail: CFSTI

Many neutron resonance parameters of nuclei with a spin value I = 3/2(Cl-35, Cl-37, Cu-63, Cu-65, 197Au) need to be determined to find the strength function S sub o with accuracy. For those nuclei, the S sub o value seems not to depend on the spin value J = 1 or 2 but could depend on neutron energy for Au-197. Total radiative width variation against mass number A and spacing distributions between resonances (for Au-197) are studied and discussed. Analysis methods of neutron capture experiments are described in detail and level schemes of Cl, Mn, Fe, Co, Cu, Tm, Hg are presented sometimes with the spin value. Intensities of F sub 1 and M sub 1 transitions with direct capture and interference effects are discussed in view of experimental results. Author (ESRO)

N70-12331# Los Alamos Scientific Lab., N. Mex.

POLARIZATION EFFECTS IN DEUTERON-ALPHA ELASTIC SCATTERING AND IN THE He 3(d,p) He 4 REACTION

Victor S. Starkovich 1 Jul. 1969 108 p refs

(Contract W-7405-eng-36)

(LA-4191) Avail: CFSTI

Azimuthal asymmetries produced in deuteron-alpha double scattering were measured at 9.0, 11.0, 11.5, and 14 MeV for a range of second-scattering angles. It was demonstrated that d-alpha elastic scattering can be used to produce a deuteron beam with useful vector polarization at energies near 10 MeV. It was also shown that d-alpha scattering can provide a useful absolute calibration for the vector polarization of a beam of deuterons produced by a polarized-ion source. Left--right proton asymmetries for the He-3(d,p)He-4 reaction were measured using a polarized deuteron beam obtained from d-alpha elastic scattering. Measurements were made for deuteron energies of 10.0, 12.0, and 14.0 MeV, using an extended range of measurements. Author (NSA)

N70-12349# United Kingdom Atomic Energy Authority, Wantage (England). Research Div.

GAMMA-RAY SPECTRA OF LARGE VOLUME AQUEOUS SOURCES

J. E. Slade Jun. 1969 20 p refs

(AERE-R-6083) Avail: HMSO 3s 6d; BIS $0.70; CFSTI

The spectra from a small liquid source Cs-137, suspended in water and detected by a NaI(T1) scintillation scintillation detector were obtained at different source positions in a plane through the axis of symmetry of the detector. Isopleths of photofraction and photopeak detection efficiency were established. The same parameters were also measured for different photon energies at points along the axis of symmetry. From these measurements spectra from large volume sources of given dimensions may be predicted. The results were used to estimate the usefulness of gamma ray spectrometry as a means of estimating the attenuation corrections to be applied in tracer experiments where the active tracer may be buried under inactive layers. Author (NSA)

N70-12368*# Stanford Univ., Calif.

RELATIVISTIC LCAO FOR THE CUBIC LATTICE. STRIKING FEATURES OF PHOTOEMISSION FROM LIQUID-NITROGEN-COOLED SILVER BROMIDE Quarterly Status Report

W. E. Spicer, T. H. Di Stefano, and R. S. Bauer 31 Oct. 1969 20 p refs

(Grant NGR-05-020-066)

(NASA-CR-107017; QSR-8) Avail: CFSTI CSCL 20H

A relativistically correct tight-binding approximation for closed shell insulators was extended and used to determine the nature and symmetry of the valence bands of cubic lattices found in heavy cesium and thallium halides. Wave functions of the closed shell ion were chosen to satisfy symmetry properties of the double group and the ionic states were expressed as superpositions of nonrelativistic ionic levels with the components given by symmetrized Wigner coefficients. As the ions are brought together into a lattice, each ionic doublet level spreads into a band of Bloch states which in turn are used to characterize valence states. Observed changes in photoemission from silver bromide upon cooling were analyzed by comparison with observed photoemissions from other materials. Results indicated that this solid has both a low Debye temperature and valence electronic wave functions localized on the atomic sites. The proximity in energy of the silver 4d levels to the bromide 4p states seemed to have a major significance because of the resulting hybridization of the valence electronic wave functions. G.G.

N70-12377# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

PACIFIC NORTHWEST LABORATORY DIVISION OF ISOTOPE DEVELOPMENT PROGRAMS Quarterly Report, Feb. – Apr. 1969

W. F. Sheely, ed. Jun. 1969 61 p refs

(Contract AT(45-1)-1830)

(BNWL-1085) Avail: CFSTI

This report discusses the development of advanced methods of acoustic emission testing for welds; use of californium 252 isotopes as neutron source in radiography; nondestructive testing of capsule welds for cobalt 60 heat sources; development and testing of different alloys as promethium 147 heat source capsules; crystal structure of neodymium, promethium, and samarium oxides; use of promethium 147 isotopes as heat source in guidance system of Advanced Manned Strategic Aircraft; rhodium 102 and palladium 107 content of irradiated reactor fuels; and physical properties of strontium silicates as radiation sources. NSA

N70-12378# Battelle-Northwest, Richland, Wash. Biological Sciences Dept.

RESPONSE OF SELECTED THERMOLUMINESCENT MATERIALS TO FAST NEUTRON EXPOSURES

G. W. R. Endres and L. F. Kocher Jul. 1969 17 p refs

(Contract AT(45-1)-1830)

(BNWL-1080) Avail: CFSTI

This current study is directed toward measuring the fast neutron response of most of the common TLD materials when placed on a polyethylene phantom to simulate actual personnel dosimetry conditions. The TLD materials used were LiF(TLD-100), LiF(TLD-600), LiF(TLD-700), Li2B4O7, and CaF2 in either pressed block or teflon matrix form. Exposures to fast neutrons were conducted using a Van de Graaff positive ion accelerator to produce monoenergetic neutrons in the energy range 0.2 to 1.0 MeV from the T(p,n) He-3 reactions. Exposures were made in air with low-scatter conditions. A phantom was placed behind the TLD material, and cadmium and boron-10 shields surrounded it for the purpose of evaluating the contribution of backscattered neutrons. The standard used for dose measurement was the Hanford precision long-counter. LiF(TLD-600) presently appears to hold the greatest promise for neutron personnel dosimetry. Author (NSA)

N70-12379# Brookhaven National Lab., Upton, N.Y. Physics Dept.

TABLE OF ANTIFERROMAGNETIC MATERIALS STUDIED BY NEUTRON DIFFRACTION

D. E. Cox Jun. 1969 91 p refs Sponsored by AEC

(BNL-13822) Avail: CFSTI

This table was originally prepared for the forthcoming edition of the American Institute of Physics Handbook. It summarizes magnetic structural data reported in the literature up to about the end of 1968. It contains considerably more descriptive detail than the version finally adopted for the Handbook, in which limitations on space ultimately necessitated a much more concise format. NSA

N70-12381# California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Materials Research Div.

CHARACTERIZATION OF MULTICHANNEL SOURCES AND THEIR UTILIZATION IN MOLECULAR BEAM SYSTEMS

D. R. Olander and R. H. Jones Jun. 1969 16 p refs Presented at 2d Intern. Symp. on High and Intermediate Energy Mol. Beams, Cannes, France, Jul. 1969

(Contract W-7405-eng-48)

(UCRL-19034; CONF-690709-1) Avail: CFSTI

Multichannel arrays have become increasingly popular sources for generating molecular beams for a variety of beam – surface and crossed-beam experiments. The properties of a molecular beam from a channel source are calculated using a model that regards intermolecular collisions in the channel as a perturbation of the distribution function for free molecule flow. The angular distribution is predicted to be less peaked than that from the same source under free molecule flow conditions. The velocity distribution is harder than a Maxwellian. Experimental data supporting these predictions are reviewed. Author (NSA)

N70-12388# International Centre for Theoretical Physics, Trieste (Italy).

HIGH-ENERGY BEHAVIOUR OF FEYNMAN AMPLITUDES IN A MODEL FIELD THEORY

D. A. Akyeampong Sep. 1969 16 p refs Submitted for publication

(IC-69-115) Avail: CFSTI

The three-dimensional space-time model of Delbourgo, Abdus Salam and Strathdee is used to study the high-energy behaviour of ladder diagrams in both the Phi to the 3rd power theory and the theory of spinor electrodynamics. It is shown that this simple but non-trivial model reproduces all the essential features needed to prove the Reggeization of the electron to sixth order. This is achieved by considering only uncrossed and some crossed diagrams since, unlike the three spatial dimensions, fourth-order radiative corrections behave like log t for large t, so that, compared with the sixth-order diagrams which behave like (log t squared), such radiative terms are unimportant and may be discarded. The model therefore gives a realistic but somewhat simpler example of a theory in which Reggeization and related ideas can be studied. Author (ESRO)

N70-12398# United Kingdom Atomic Energy Authority, Risley (England). Authority Health and Safety Branch.

REVISED FISSION CROSS SECTION EVALUATIONS FOR THE ENERGY RANGE 1 keV TO 15 MeV

W. Hart 1969 32 p refs

(AHSB(S)R-169) Avail: HMSO 5s 6d; BIS $1.10; CFSTI

The remaining regions of major uncertainty are associated with the ratio measurements (relative to U-235 rather than the absolute determination of the U-235 cross section. The discrepancies are most dramatic below about 80 keV in which range much reliance was placed on the 24-keV measurements previously published. Revised cross sections are tabulated. Author (NSA)

N70-12400# Atomics International, Canoga Park, Calif.

CALCULATION OF REACTION RATES IN SMALL PHYSICAL REGIONS BY MEANS OF A NEW NON-MULTIGROUP ADJOINT MONTE CARLO TECHNIQUE

L. B. Levitt, R. C. Lewis, and J. Spanier 15 Mar. 1969 42 p refs

(Contract AT(04-3)-701)

(AI-AEC-12774) Avail: CFSTI

The use of adjoint Monte Carlo in the study of reaction rates in small spatial regions of a reactor has an advantage over direct Monte Carlo techniques, in that it samples random walks from the "detector" (the small region under study) to the neutron source, rather than the reverse procedure which actually occurs. A new adjoint Monte Carlo technique is described which appears to be very useful for solving problems in the slowing-down region below the threshold for inelastic scattering. This basis for the technique is the idea of exactly reversing direct Monte Carlo random walks, first used in the combined adjoint-direct Monte Carlo procedure developed for analysis of resonance integral experiments. The extension of the backward random walk to a complete adjoint Monte Carlo calculation permits the calculation of absolute reaction rates, whereas the combined technique was limited to relative reaction rates. Author (NSA)

N70-12424# Oak Ridge National Lab., Tenn.

ISOTOPES INFORMATION CENTER KEYWORD THESAURUS

Robert H. Lafferty, Jr., ed. Jul. 1969 98 p

(Contract W-7405-eng-26)

(ORNL-IIC-24) Avail: CFSTI

The thesaurus of keywords used by the Isotopes Information Center of Oak Ridge National Laboratory is presented in both hierarchical and alphabetical arrangement, together with a cross-reference list and some instructions on how to index. Author (NSA)

N70-12425# Oak Ridge National Lab., Tenn.

SOURCE APPLICATION GUIDE BASED ON THE ORNL SOURCE CAPSULE CLASSIFICATION SYSTEM

R. G. Niemeyer Jul. 1969 62 p refs

(Contract W-7405-eng-26)

(ORNL-4427) Avail: CFSTI

A system has been developed for classifying a wide variety of radioactive source capsules according to their containment integrity and their intended use and use environment. The system consists of a Source Application Guide and of a revised Source Capsule Classification System. The Application Guide establishes a suggested capsule classification by evaluating the key containment factors involved in source usage and relating them to the containment reliability of the capsule as expressed by the Classification System. The test procedures required with the Classification System and a few examples of how to use the Application Guide are appended. Author (NSA)

N70-12455# Union Carbide Corp., Oak Ridge, Tenn. Computer Technology Center.

PEPSI: PLASMA ELECTRON PROFILES, SYMMETRIC INTEGRALS. A PROGRAM THAT MODELS THE MAGNETIC FIELD CONFIGURATION IN A THERMONUCLEAR PLASMA

Randall C. DeLozier, James E. Park, and G. E. Guest (ORNL) 4 Sep. 1969 121 p refs

(Contract W-7405-eng-26)

(CTC-16) Avail: CFSTI

A FORTRAN-coded program that models the self consistent magnetic field configuration in a dense, energetic plasma is described. The code was developed to study hot electron distributions such as those found in a strongly diamagnetic plasma and allows for a wide range of assumed electron distributions. The program enables the user to study the effect on the equilibrium plasma distributions of different plasma pressures and spatial configurations. Instructions for using the code and a sample problem with input and output sheets are included. Author (NSA)

N70-12458# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.

NUCLEAR REACTOR NEUTRON DETECTION AND MEASUREMENT DEVICES

Emanuel Lewis Oct. 1968 110 p refs
(Contract W-31-109-eng-52)
(KAPL-M-6961) Avail: CFSTI

Properties of neutrons are described including interactions of neutrons with matter, nuclear cross sections, variation of cross section with neutron energy, and slowing down of neutrons. Reactions used to detect thermal and epithermal neutrons are discussed including charged particle reactions, fission reactions, and induced radioactivity; and reactions used to detect fast neutron are discussed including proton recoil and threshold reactions. Also, the operation and performance of neutron detectors are described. Ionization chambers, proportional counters, semiconductor detectors thermopiles, activation foils, and self powered detectors (reaction initiated current flow) are considered. Advantages and disadvantages of each detector for reactor control and monitoring and reactor experimentation are discussed. NSA

N70-12460# Maryland Univ., College Park. Dept. of Physics and Astronomy.

INVESTIGATIONS ON THE PROPERTIES OF K MESONS AND HYPERONS AND RELATED TOPICS IN HIGH ENERGY PHYSICS Progress Report, 1 Oct. 1968 – 30 Sep. 1969

Jul. 1969 48 p refs
(Contract AT(40-1)-2504)
(ORO-2504-142; TR-70-004) Avail: CFSTI

Research on the fundamental properties of elementary particles and their properties is reviewed. Kaon and hyperon interactions and properties are studied primarily. The progress of the experimental counter-spark chamber program, the bubble chamber and theoretical program, and PEPR project status are reviewed. A list of publications under AEC contract is given. Author (NSA)

N70-12473# Commissariat à l'Energie Atomique, Limeil (France).

CROSS SECTIONS FOR THE PRODUCTION OF GAMMA RADIATION BY 5 MeV, 6.6 MeV AND 8.7 MeV NEUTRONS ON CARBON, ALUMINIUM, IRON AND BISMUTH [SECTIONS EFFICACES DE PRODUCTION DE RAYONNEMENT GAMMA PAR DES NEUTRONS DE 5 MeV, 6.6 MeV ET 8,7 MeV SUR LE CARBONE, L'ALUMINIUM, LE FER ET LE BISMUTH]

André Bertin, Francoise Bertrand, Geneviève Clayeux, Michèle Gautier, and Georges Nierat Jul. 1969 47 p refs In FRENCH; ENGLISH summary
(CEA-R-3808) Avail: CFSTI

A study has been made of the gamma spectra of C, Al, Fe and Bi using a spectrometer placed at 90 deg. The different samples are bombarded by neutrons at energies of 5 MeV, 6.6 MeV and 8.7 MeV. The cross sections for gamma production have been calculated for levels which are particularly well resolved and for which the statistical error is less than 2 per cent. The gamma radiation observed has an energy of 4.43 MeV for C-12; 0.842 MeV, 1.013 MeV, 1.72 MeV and 2.21 MeV (2.976 MeV–3 MeV) for Al-27, 0.850 MeV, 1.03 MeV, 1.24 MeV and 1.81 MeV (2.09 MeV–2.11 MeV) and 2.6 MeV for Fe-56, and 0.90 MeV and 1.605 MeV for Bi-209. The values in mb/sr at 90 are given to ±22 percent up to E = 2 MeV and 222 percent above this value. Author (ESRO)

N70-12477# National Bureau of Standards, Washington, D.C.

MULTIPLE SCATTERING CORRECTIONS FOR THE ASSOCIATED-PARTICLE NEUTRON TIME-OF-FLIGHT TECHNIQUE

Allan C. B. Richardson Oct. 1969 69 p refs
(NBS-TN-499) Avail: SOD $0.65

The computer code, MAGGIE, for the calculation of multiple scattering and sample attenuation in neutron differential cross section measurements, is revised and corrected. The particular case of the scattering geometry required by the associated-particle time of flight is considered in detail. Author

N70-12489# Iowa State Univ. of Science and Technology, Ames.

HYPERPLANE FORMALISM AND ITS APPLICATION TO THE THEORY OF ELEMENTARY PARTICLES

Stanley Clifton Mc Donald (Ph.D. Thesis) May 1969 72 p refs
(Contract W-7405-eng-82)
(IS-T-303) Avail: CFSTI

The principle of covariance as applied to the theory of elementary particles is further exploited by extending Fleming's hyperplane formalism to include a discussion of the operations of the Poincaré group as seen by an arbitrary hyperplane observer. The hyperplane generalization of the infinitesimal generators of the connected part of the Poincaré group are constructed by performing a Lorentz transformation on the canonical generators, and are seen to be those operators previously defined by Fleming. Helicity basis states for the $m^2 > 0$ irreducible representations of the Poincaré group are re-expressed within the framework of generalized covariance provided by the hyperplane formalism, and are seen to be related to the conventional helicity states of Jacob and Wick by a special Lorentz transformation. In a similar fashion, the canonical states constructed by Foldy are generalized to an arbitrary hyperplane. The localized states of Newton and Wigner are reconstructed as a superposition of the canonical states, and these states are also generalized to an arbitrary hyperplane via a procedure similar to that used for the hyperplane generalization of the helicity and canonical states. The corresponding position operator, with mutually commuting components, is then constructed, and is seen to be equivalent to that operator given by Fleming. Author (NSA)

N70-12492# Brookhaven National Lab., Upton, N.Y.

NEUTRON RESONANCE STRUCTURE OF ER-164 AND PARAMAGNETIC SCATTERING OF ER-168

S. F. Mughabghab, R. E. Chrien, and M. R. Bhat [1968] 13 p Presented at the Joint Meeting of the Amer. Phys. Soc. and The Can. Assoc. of Physicists, Toronto Supported by AEC
(CONF-670653-1) Avail: CFSTI

Resonance parameters for Er-164 from 7.9 to 225.2 eV were extracted from transmission data obtained with the fast chopper facility at the BNL Graphite Reactor. Average level spacings were determined for Er-164 and Er-167. Transmission data on Er-168 yielded a value of 33.6 + or – 2.0 b for the total cross section of Er-168 at 0.025 eV. A paramagnetic scattering cross section of 26.1 + or – 2.5 b was extracted from the total cross section of Er-168. NSA

N70-12508# Oak Ridge National Lab., Tenn. Physics Div.

OAK RIDGE NATIONAL LABORATORY PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING 31 DECEMBER 1968

P. H. Stelson, ed. May 1969 165 p refs
(Contract W-7405-eng-26)
(ORNL-4395) Avail: CFSTI

Work completed and in progress during 1968 by the Physics Division of Oak Ridge National Laboratory is reported. The work included nuclear reaction studies, nuclear structure and model studies, instrumentation studies, and elementary particle studies. NSA

N70-12509# Florida Univ., Gainesville. Dept. of Nuclear Engineering Sciences.

CHEMICAL STRUCTURAL STUDIES BY NUCLEAR TECHNIQUES AND NUCLEAR FISSION SYSTEMATICS

Yearly Progress Report, 1 Mar. 1968 - 28 Feb. 1969
William H. Ellis, Ugur Ortabasi, and Kesi Nair 1 Mar. 1969 114 p refs
(Contract AT(40-1)-3345)
(ORO-3345-4) Avail: CFSTI

Research activities undertaken with time-dependent angular correlation (TDAC) measurements associated with the study of chemical structure by nuclear techniques are described. The TDAC measurements demonstrated that static field hyperfine quadrupole interaction effects can be observed for rare earth ions in polycrystalline environments and that time-dependent perturbed angular correlation (TDPAC) measurements are practical with Tm-169 gamma cascades. A distinct cycle behavior was observed for the single-angle time dependent coincidence spectra and the time dependence of anisotropy. Investigations were also made of the effect of a nonuniform nuclear charge distribution on fission fragment mass asymmetry. An analytical model was developed for describing the dynamic interrelationship of factors determining the total energy of a deforming nucleus represented as a charged liquid drop having nonuniform charge density. NSA

N70-12531# Oak Ridge National Lab., Tenn. Electronuclear Div.
INTRODUCTION TO THE STATE OF HEAVY ION ACCELERATOR PROJECTS
Robert S. Livingston Jul. 1969 33 p refs Presented at the Intern. Conf. on Nucl. Reactions Induced by Heavy Ions, Heidelberg, 15 - 18 Jul. 1969
(Contract W-7405-eng-26)
(ORNL-TM-2662; CONF-690707-1) Avail: CFSTI

The early history of acceleration of heavy ions is reviewed. Tables have been compiled of typical performance for present day heavy ion accelerators of various types. Data showing typical performance of several ion sources have been plotted. A review is made of the potentialities and limitations of the most common accelerator systems. A list of known proposals for new accelerators is presented. Author (NSA)

N70-12534# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
ASYMPTOTIC STATES IS NONLOCAL FIELD THEORY
M. Z. Iofa 1969 8 p refs Presented at the Third Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, USSR In RUSSIAN
(ITF-69-26) Avail: AEC Depository Libraries

The existence of asymptotic states is proved in the nonlocal field theory with a sufficiently rapidly decreasing commutator in space-like directions. Author (NSA)

N70-12557# California Univ., Livermore. Lawrence Radiation Lab.
PHOTONEUTRON CROSS SECTIONS OF Mg-24 AND Mg-26
S. C. Fultz, B. L. Berman, J. T. Kelley, M. A. Kelly, and R. R. Harvey 27 Jun. 1969 8 p Presented at Gordon Conf. for Photonucl. Reactions, Tilton, N.H. Submitted for publication Sponsored by AEC
(UCRL-71828; CONF-690816-5) Avail: CFSTI

Photoneutron cross sections for Mg-24 and Mg-26 were measured as a function of photon energy from about 11 to 28 MeV. NSA

N70-12583# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
NEW CROSS SECTIONS FOR GAM, TNS, AND BIT LIBRARIES
M. J. Schneider 15 Apr. 1969 74 p refs Sponsored by AEC
(WANL-TME-1920) Avail: CFSTI

Additions and changes in the neutron cross sections for the GAM, TNS, and BIT libraries are reported. NSA

N70-12589# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
WIGHTMAN FORMULATION FOR THE NONLOCALIZABLE FIELD THEORY. PART 2: THEORY OF ASYMPTOTIC FIELDS AND PARTICLES
M. Z. Iofa and Ya. V. Fainberg 1969 20 p refs Presented at the Third Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, USSR In RUSSIAN
(ITF-69-25) Avail: AEC Depository Libraries

It is shown that in the nonlocalizable and consequently nonmicrocausal field theories where Wightman functions increase exponentially in momentum space and satisfy the quasilocality condition, it is possible to construct a theory of asymptotic fields and particles i.e., to prove the existence of the unitary CPT-invariant S-matrix. Author (TAB)

N70-12571# Gulf General Atomic, San Diego, Calif.
GAMTRI: A PROGRAM FOR THE SOLUTION OF THE MULTIGROUP NEUTRON-DIFFUSION EQUATIONS IN TRIANGULAR GEOMETRY WITH ARBITRARY GROUP SCATTERING, FOR THE UNIVAC-1108 COMPUTER
J. P. Dorsey and R. Froehlich 12 May 1969 114 p
(Contract AT(04-3)-167)
(GA-9201) Avail: CFSTI

The numerical methods used in the program are described. The operating instructions for the program are given and a sample problem is presented. NSA

N70-12573# Southern Univ. Nuclear Inst., Faure (South Africa).
ACTIVITIES OF THE SOUTHERN UNIVERSITIES NUCLEAR INSTITUTE FOR 1968 Annual Report
W. R. McMurray, comp. Dec. 1968 37 p Sponsored by South African Atomic Energy Board and CSIR
(NP-17890) Avail: AEC Depository Libraries

Nuclear research activities are reported. Subjects include: (1) energy levels of deuteron, alpha reactions with compound nucleus of aluminum 26 and 27, argon 37, calcium 43 and 48, and silicon 29, and (2) DWBA analysis of deuteron reactions (d,n) with boron 10, and carbon 13. NSA

N70-12598# Gulf General Atomic, San Diego, Calif.
GAMMA-RAY TRANSPORT IN LIQUID NITROGEN Final Report
G. M. Reynolds 30 May 1969 79 p refs
(Contract DASA-01-68-C-0088)
(AD-693618; DASA-2331; GA-9429) Avail: CFSTI CSCL 18/8

An important part of the radiation dose in the transport of fast neutrons through matter is the nuclear gamma radiation. Confidence in the ability to calculate the production and transport of the gamma radiation can be gained by comparison with measurements, preferable with simple geometry. This study concerns 14N because of its importance in the air transport problem. A Cockcroft-Walton type neutron generator produced a source of 14 MeV neutrons in the center and near the bottom of a large cylindrical tank of liquid nitrogen. Gamma rays produced by the interaction of these 14 MeV neutrons with the nitrogen nuclei were detected with a lithium drifted germanium detector. Separation of the fast gamma spectrum from the thermal capture spectrum was effected by pulsing the neutrons. The simple geometry approximates a point neutron source in an infinite medium of liquid nitrogen. Author (TAB)

N70-12601# United Kingdom Atomic Energy Authority, Harwell (England). Nuclear Physics Div.
A GAS TARGET SYSTEM FOR CONTINUOUS PRODUCTION AND RAPID ISOLATION OF THE SHORT-LIVED RADIOISOTOPE AR-35

G. L. Wick May 1969 20 p refs
(AERE-R-6091) Avail: CFSTI; UK: 3s 6d

A detailed description is given of the design and operation of a continuous flow gas target system used for the production and isolation of Ar-35. Vaporous CCl4 was used as the target material for the reaction Cl-35(p,n)Ar-35. In subsequent stages the Ar-35 was separated from the carrier gas CCl4 and transported to a shielded region where the decay Ar-35(positron)Cl-35 was studied. Author (NSA)

N70-12628# Commissariat a l Energie Atomique, Scalay (France). CEA Lab. de Metrologie de la Radioactivite.
VALIDITY OF RADIOACTIVE STANDARDS [VALIDITE DES ETALONS RADIOACTIFS]
Yves le Gallic [1968] 13 p in FRENCH; ENGLISH summary Presented at the Intern. Conf. on the Constructive Uses of Atomic Energy, Washington, D.C., 11 Nov. 1968
(CEA-CONF-1238; CONF-681101-17) Avail: AEC Depository Libraries

The validity of primary and secondary radioactive standards is considered, and the factors affecting their validity are discussed. the validity of standards depends on exact preparation of primary standards in each metrology laboratory, concerted international effort to determine the fundamental constants (decay scheme, half-lives, etc.), and an international agreement for the normalization of the expression of results and errors. NSA

N70-12629# Colorado Univ., Boulder. Dept. of Physics and Astrophysics.
STUDY OF THE EFFECTIVE TWO-BODY FORCE USING THE FE-54(HE-3,T) CHARGE EXCHANGE REACTION
S. I. Hayakawa, J. J. Kraushaar, P. D. Kunz, and E. Rost [1969] 13 p refs Supported by AEC
(COO-535-593) Avail: CFSTI

Differential cross sections were measured for the Fe-54(He-3,t)Co-54 reaction at 37.5 MeV. The T = 1 states are well described using a conventional microscopic DWBA analysis, but similar analysis of the T = 0 states indicates a serious discrepancy between theory and experiment. Author (NSA)

N70-12630# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
ELECTRON ANTINEUTRINO INTERACTION WITH DEUTERONS
T. L. Jenkins, F. E. Kinard, and F. Reines [1968] 33 p refs Sponsored by AEC Prepared in cooperation with Du Pont de Nemours (E. I.) and Co. and Calif. Univ., Irvine
(COO-1749-9) Avail: CFSTI

The reaction electron antineutrino(d,2n)positron was observed using antineutrinos from a powerful fission reactor. The measured cross section equals 3.0 + or - 1.5 times 10 to the -45 power sq cm/fission is consistent with expectations, the theoretical cross section being 2.4 + or - 0.4 times 10 the to the -45 sq cm/fission, based on the two component neutrino theory and elementary considerations regarding the structure of the deuteron. Author (NSA)

N70-12631# Brookhaven National Lab., Upton, N.Y. Accelerator Dept.
REMARKS ON FIELD EMISSION IN SUPERCONDUCTING rf CAVITIES
J. Halbritter 20 Jul. 1969 11 p refs Sponsored by AEC
(BNL-13890; AADD-157) Avail: CFSTI

An analysis of prebreakdown field-emitted electron currents in superconducting RF cavities is presented. It shown that those currents are able to cause a frequency shift. With these current occurring, processing of TM modes in superconducting cavities possibly causes the burnt dark spots observed in niobium and lead cavities. Author (NSA)

N70-12632# California Univ., Livermore. Lawrence Radiation Lab.
PHOTONEUTRON CROSS SECTIONS FOR Ba-138 AND N-14
B. L. Berman, S. C. Fultz, J. T. Caldwell, and M. A. Kelly 27 Jun. 1969 7 p refs Presented at Gordon Conf. for Photonucl. Reactions, Tilton, N.H. Submitted for publication Sponsored by AEC
(UCRL-71827; CONF-690816-1) Avail: CFSTI

Photoneutron cross sections for Ba-138 and Na-14, were measured as a function of photon energy from threshold to 30 MeV. NSA

N70-12633# Lockheed-Georgia Co., Marietta. Nuclear Lab.
EVALUATION OF METHODS FOR COMPUTING NUCLEAR ROCKET RADIATION FIELDS
[1969] 128 p
(Contract NAS8-9500)
(NASA-CR-102338; ER-8236) Avail: CFSTI CSCL 20H

The point-kernel, discrete ordinates, and Monte Carlo methods are compared emphasizing usefulness in analysis and design of nuclear rocket systems. Codes selected for investigation were the following: point-kernel programs 14-0(and 14-1), and QAD-P5 (and QAD-IV); discrete ordinates programs DDK and DTK; and Monte Carlo programs 18-0, MCS and MCG. The suitability of the point-kernel method for preliminary parametric studies, the Monte Carlo methods for design point verification, and discrete ordinates for estimation of fission and radiative capture distributions over the reactor-shield assemply was established. Other conclusions include: (1) Parametric point kernel neutron estimates should always be compared with a representative Monte Carlo computation performed simultaneously, and adjusted; (2) MCS/MCG programs are preferable to the 18-0; (3) two-dimensional DDK is preferred to the faster DTK; (4) assessment od differences in test-stand and deep-space radiation environments over the nculear stage appears marginally feasible with the programs studied, but only with miltiple computations of separate radiation components. M.H.E.

N70-12641# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
AUSTRALIAN INST. OF NUCLEAR SCIENCE AND ENGINEERING. [ACTIVITIES OF THE AUSTRALIAN INSTITUTE OF NUCLEAR SCIENCE AND ENGINEERING INSTITUTE OF NUCLEAR SCIENCE AND ENGINEERING] Annual Report for Year Ending 31 Dec. 1968
31 Dec. 1968 43 p refs
(NP-17921) Avail: AEC Depository Libraries

The activities of the Australian Institue of Nuclear Science and Engineering during the year ended 31st December 1968 are summarized. The Institute is an independent organization established to assist nuclear research and training in Australia and to make available, to Australian Universities nuclear reactors and other facilities at the Australian Atomic Energy Commission's Research Establishment at Lucas Heights. Activities include conferences on nuclear physics and radiation chemistry, neutron diffraction studies, research and training grants, fellowships and studentships. A list of A.I.N.S.E. sponsored university research projects is attached. NSA

N70-12645# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
TESTS OF THE GGC-3, GGC-4 NEUTRON SLOWING DOWN CODES AND COMPARISONS WITH THE CODES GAMBIT AND TRANSFER

Gordon Gibson and L. L. Moran May 1969 38 p refs
Avail: CFSTI

The GGC-3 and GGC-4 programs for multigroup cross sections are compared with the GAMBIT and TRANSFER programs. Some calculations done by the GGC-3 and GGC-4 codes on the CDC-6600 are presented and compared with similar calculations done by the GAMBIT and TRANSFER codes. NSA

N70-12648# Syracuse Univ., N.Y. Dept. of Physics.
OMEGA DECAY
D. N. Goswami and J. Schechter Jun. 1969 27 p
(NYO-3399-199; SU-1206-199) Avail: CFSTI

The Omega hyperon(−) nonleptonic decays are investigated in the framework of a chiral Lagrangian model. In this way, ambiguities of extension of meson momenta to zero which are present in the current algebra approach are made explicit. It is found that these decays may possess a rather complicated structure and a discussion of approximation schemes is given which may help to explain the present experimental data. The approximation of the Xi hyperon 2 pion decay mode by Xi hyperon pion is also discussed. Author (NSA)

N70-12658*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPARATUS FOR OBTAINING ISOTROPIC RADIATION OF A FILM EMULSION Patent Application
Lester Katz, inventor (to NASA) Filed 3 Sep. 1969 15 p
(NASA-Case-MFS-20095; US-Patent-Appl-SN-855004) Avail: CFSTI CSCL 20H

Described is an apparatus for moving a film emulsion in a path of high energy particles so as to obtain essentially an isotropic exposure. The apparatus rotates the film on a turntable along one axis and simultaneously shifts the turntable up and down within a limited range. NASA

N70-12658# Brookhaven National Lab., Upton, N.Y.
SOME HIGH-CURRENT EFFECTS IN PARTICLE ACCELERATORS
E. D. Courant 1969 6 p refs Presented at 7th Intern. Conf. on High Energy Accelerators, Yerevan, USSR, 27 Aug.–2 Sep. 1969 Sponsored by AEC
(BNL-13942; CONF-690811-6) Avail: CFSTI

Instabilities and beam losses due to electromagnetic fields produced by high-current beams in accelerators are discussed. Space charge defocusing effects and negative mass instability are considered. Methods for compensation of longitudinal space-charge defocusing are discussed. NSA

N70-12659# Vanderbilt Univ., Nashville, Tenn.
ELECTRON SPIN RESONANCE STUDIES OF IRRADIATION INDUCED VALENCE CHANGES AND GROUND STATE SPLITTINGS OF RARE EARTH IONS IN CUBIC AND AXIAL CRYSTAL FIELDS
Robert Ware Reynolds (Ph.D. Thesis) Jun. 1969 119 p refs Sponsored by AEC and Vanderbilt Univ.
(TID-25126) Avail: CFSTI

The ground-state splitting of rare earth and actinide ions with total angular momentim J = 7/2 was determined in cubic tetragonal, and trigonal crystalline electric fields. In a cubic field with eightfold coordination (SrCl2), the eightfold degenerate free ion ground state of Yb(3+) and Tm(2+) is split, leaving a doubly degenerate gamma sub 7 ground state, while in a sixfold coordinated cubic site (CaO), the ground state of these ions are doubly degenerate gamma sub 6 states. These results are in agreement with the predictions of the point charge model of the crystal field. The ground state wavefunctions of Yb(3+) in tetragonal sites of CaO have a form only slightly different from those of Yb(3+) in cubic sites indicating a weak axial distortion. The Yb g-values for the tetragonal site show that the distortion is due to a negative charge compensation site. Due to the weak interaction of the S-state ion with the crystal field, it was possible to measure this splitting as a function of temperature. The symmetry of the ESR spectra in these hosts determined that the local crystal structure of each was similar. Author (NSA)

N70-12668# Purdue Univ., Lafayette, Ind. Nuclear Structure Lab.
RESEARCH IN NUCLEAR PHYSICS Progress Report, 1 Jun. 1968 – 31 May 1969
R. M. Steffen 15 Jun. 1969 52 p refs
(Contract AT(11-1)-1746)
(COO-1746-24; PR-2) Avail: CFSTI

Installation work on the FN-tandem Van de Graff accelerator system is described. Scattering chambers designed for experiments with the tandem accelerator are explained. Associated research activities are described in nuclear spectroscopy using radioactive isotopes which included Coulomb excitation experiments performed at the Argonne National Laboratory tandem accelerator. M.H.E.

N70-12669# California Univ., Lawrence Radiation Lab.
PROPERTIES OF THE ETA' MESON
Alan Rittenberg (Ph.D. Thesis) 4 Jun. 1969 128 p refs
(Contract W-7405-eng-48)
(UCRL-18863) Avail: CFSTI

The eta' (958) meson was studied in the reaction negative kaon plus proton yields Lambda hyperon plus eta' meson, with negative kaon beam momenta ranging from 1.70 to 2.65 GeV/c. The Dalitz plots of eta' meson decay into positive pion plus negative pion plus eta meson and positive pion plus negative pion plus gamma were examined, and from them the most likely quantum numbers of the eta' meson were determined. It was also shown that the decay into positive pion plus negative pion plus gamma is mediated by the decay eta' meson yields neutral rho meson plus gamma. Author (NSA)

N70-12672# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnoi Fiziki.
TOWARD A THEORY OF RESONANCE REACTIONS IN THE REGION OF OVERLAPPING LEVELS [K TEORII REZONANSNYKH REAKTSII V OBLASTI PEREKRYVAYUSHCHIKHSYA DROVNEI]
A. E. Kudryavtsev 1969 12 p refs In RUSSIAN
(ITEF-659) Avail: CFSTI

A formula is derived which describes the energy dependence of the reaction amplitude. It is shown that the total width of the giant resonance differs from the sum of particl widths by the nonlinear terms in the level density. Author (NSA)

N70-12677# European Organization for Nuclear Research, Geneva (Switzerland).
POLARIZATION EXPERIMENTS TO TEST T- AND CPT-INVARIANCE IN NUCLEON-NUCLEON AND NUCLEON-ANTINUCLEON SCATTERING
S. M. Bilenskii et al Sep. 1969 16 p refs Transl. into ENGLISH from Russian report JINR-P2-3716)
(CERN-Trans-68-9; JINR-P2-3716) Avail: AEC Depository Libraries

Experiments to test T invariance in elastic proton – proton scattering are discussed. Also a brief study is made of the possible experiments for testing CPT invariance during elastic scattering antiprotons by protons. NSA

N70-12686# Institute of Nuclear Physics, Krakov (Poland).
HIGH ENERGY COLLISIONS OF HADRONS AND NUCLEI
W. Czyz Mar. 1969 36 p Presented at Inaugural Conf. of

European Phys. Soc., Florence, 8-12 Apr. 1969
(INP-678; CONF-690421-1; Rept-678-PL-PH) Avail: CFSTI

Applicability of the high energy scattering model of strongly interacting composite particles to nuclear and hadronic scattering is discussed using the examples of pion – d, p – O-16 and p – p high energy elastic scattering. Author (NSA)

N70-12697# Chicago Univ., Ill. Institute for the Study of Metals
THEORETICAL AND EXPERIMENTAL STUDIES IN CHEMICAL PHYSICS Final Report
Stuart A. Rice Dec. 1968 716 p refs
(Grant AF-AFOSR-781-65)
(AD-693324; AFOSR-69-2129TR) Avail: CFSTI CSCL 20/12

The study of the triplet states of molecules and molecular crystals has been pursued. The subject divides into two parts: The study of the triplet states of isolated molecules; The study of triplet excitons in molecular crystals. The report considers both. Only the major features of the analyses are given. This report is concerned with three related topics: The theory of triplet Rydberg states of molecules. The theory of triplet excitons in crystals of aromatic hydrocarbons. The theory of triplet excitons in crystalline I2. Author (TAB)

N70-12703# International Centre for Theoretical Physics, Trieste (Italy).
SUM RULES FROM SUGAWARA'S THEORY OF CURRENTS
M. O. Taha Jul. 1969 26 p refs Submitted for publication
(IC-69-62) Avail: CFSTI

An integral representation is given for the matrix element, between single-particle states, of the product of currents at the same space-time point. It is applied to obtain sum rules from the equations of motion in the Sugawara model. Author (ESRO)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N70-11511# Harvard Coll. Observatory, Cambridge, Mass.
REFLECTION, REFRACTION AND COUPLING OF; MHD WAVES AT A DENSITY STEP
Robert F. Stein Apr. 1969 114 p refs
(Contract AF 19(628)-3877)
(AD-693575; Scientific-6; AFCRL-69-0307) Avail: CFSTI CSCL 20/9

The transmission and reflection coefficients for MHD waves incident on a density step are calculated. All three modes (fast, slow and Alfven) are coupled together except when the magnetic field is in the plane of incidence or the plane of the interface. Results for arbitrary orientations of interface normal, magnetic field and incident wave vector are shown in a series of graphs. Strong coupling between modes occurs for incident wave vectors nearly parallel the magnetic field. Author (TAB)

N70-11573*# Techtran Corp., Glen Burnie, Md.
SPECTRUM OF ALUMINUM PLASMA EXCITED BY LASER RADIATION [SPEKTR ALYUMINEVOY PLAZMY VOZBUZHDAYEMOY LAZERNYM IZLUCHENIYEM]
B. M. Zhiryakov et al Washington NASA Nov. 1969 4 p refs Transl. into ENGLISH from Zh. Prik. Spectroskipii (USSR), v. 10, no. 1, 1969 p 143 – 145
(Contract NASw-1695)
(NASA-TT-F-12694) Avail: CFSTI CSCL 20I

Some specifics of the spectrum of aluminum, excited by laser radiation are described. The processes of interaction of radiation and material are dependent on the mode of operation of the laser. The kinetics of the process were studied by high speed photography. Author

N70-11574*# Techtran Corp., Glen Burnie, Md.
COMPARISON OF THE POSSIBILITIES FOR ELIMINATING THE EFFECTS OF THIRD ELEMENTS WITH PULSED DISCHARGES AND LASERS [STRAVENIE VOZMOZHNOSTEV USTRANENIYA VLIYANIY TRETIKH ELEMENTOV PRI ISPOLZOVANII IMPULSNYKN RAZRYADOV I OKG]
V. V. Panteleyev et al Washington NASA Nov. 1969 6 p refs Transl. into ENGLISH from Zh. Prik. Spektroskopii (USSR), v. 9, no. 6, 1968 p 923 – 927
(Contract NASw-1695)
(NASA-TT-F-12695) Avail: CFSTI CSCL 20I

A comparative investigation is described for the possibilities of eliminating the influence of third elements in free and localized low voltage pulse discharges and in laser pulses produced in the free generation mode. The high energy density of the laser pulse produces a calibration graph for zinc concentration in brasses which is steeper than that produced with the electric discharge, and is less influenced by the presence of silicon. Author

N70-11604# Air Force Cambridge Research Labs., Bedford, Mass.
PLASMA RADIATION MECHANISMS IN ASTROPHYSICS
S. A. Kaplav and V. N. Tsytovich Aug. 1969 72 p refs Transl. into ENGLISH from Plazmennye Mekhanizmy Izlucheniya v Astrofizike (Moscow) 1968
(AD-693601; AFCRL-69-0356) Avail: CFSTI CSCL 3/2

The paper discusses problems and applications of plasma physics and its revelance to astrophysics. A method of interpreting radio emission of variable quasars is suggested. Author (TAB)

N70-11750# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE NONLINEAR FOCUSING OF ELECTROMAGNETIC WAVES IN A TWO-LEVEL SYSTEM
V. B. Krasovitskii et al 5 Jun. 1969 8 p refs Transl. into ENGLISH of the book 'Vysokochastotnye Svoystva Plazmy' Kiev, Akad Nauk, 1967 p 49 – 52
(AD-693005; FTD-HT-23-122-68) Avail: CFSTI CSCL 20/9

The authors examine the focusing of an electromagnetic wave in a two-level field. The nonlinear relationship between the polarized vector and the electric field was equated. As a result of the equations it was determined that the presence of discontinuities in polarized mediums is possible. TAB

N70-11770# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE THEORY OF ION RESISTANCE
A. V. Bogdanov 1 Jul. 1969 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk Adzh. SSR, Otd. Fiz. Tekhn. I Khim. Nauk (Stalinabad, USSR), no. 1 – 19, 1966 p 20 – 23
(AD-693475; FTD-HT-23-130-68) Avail: CFSTI CSCL 20/9

The purpose of the paper was to develop a theory for calculating resonant excitation in a plasma. The initial force equation for the influence of an external alternating voltage on an ion plasma is shown. Excitation of ion resonance in a plasma is possible with both electromagnetic and ultrasound frequencies; however, at present, excitation of ion-resonant oscillations with frequencies above 1 GHz 10 (superscript 8) minus 10 (superscript 9) hertz 1 GHz is not technically feasible. It is suggested that this difficulty can be avoided by inserting in the plasma a piezoelectric crystal with specific dimensions. TAB

N70-11777*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STUDY OF THE THERMAL PLASMA ON CLOSED FIELD LINES OUTSIDE THE PLASMASPHERE
H. G. Mayr, J. M. Grebowsky, and H. A. Taylor, Jr. Jul. 1969 31 p refs
(NASA-TM-X-63736; X-621-69-299) Avail: CFSTI CSCL 20I

Using OGO 4 ion composition measurements near the midlatitude light ion trough below 1000 kilometers, a model for the plasma state along the magnetic field lines is developed. It produces, in the equatorial plane, the sharp density gradient characteristic of the plasmapause. In this model the field aligned plasmasphere boundary is a boundary across which the characteristics of the proton flux along the field lines change. Within the plasmasphere the proton fluxes along the field lines are of small or vanishing magnitude and may be directed either away from or towards the earth. By contrast, the small equatorial ion densities known to exist on closed field lines outside the plasmasphere are consistent with the measured low altitude densities only if large proton fluxes, of the order of the critical flux, are directed along the field lines. These latter fluxes are directed away from the earth and correspond to the attainment of supersonic proton flow velocities on closed field lines outside the plasmasphere. This is consistent with the model of a supersonic polar wind convecting onto closed field lines.
Author

N70-11810*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
POTENTIAL DISTRIBUTION SURROUNDING A PHOTO-EMITTING PLATE IN A DILUTE PLASMA
Ralph L. Guernsey and Jerry H. M. Fu 1969 42 p refs
(Grant NGL-21-002-005)
(NASA-CR-106966; TN-BN-605) Avail: CFSTI CSCL 20I

The potential distribution in the neighborhood of a photo-emitting plate immersed in a plasma is calculated. We find that two steady state potential distributions can exist, namely one in which the potential decreases from its plate value to zero monotonically and one in which it decreases from its plate value to a (negative) minimum and then increases slowly to zero. This latter over shoot potential appears to be the stable one. Such over shoot effects are expected to play an important role for sheaths around satellites in the interplanetary plasma.
Author

N70-11844# Stanford Univ., Calif. Inst. for Plasma Research.
HIGH-FREQUENCY BEAM-PLASMA INTERACTION AT FINITE TEMPERATURES
May 1969 5 p refs Presented from the 9th Intern. Conf. on Phenomena in Ionized Gases, Bucharest, Sep. 1969
(Contract AT(04-3)-326)
(SU-IPR-297; CONF-690803-11) Avail: CFSTI

It is shown theoretically that even a moderate plasma temperature significantly reduces the growth rate of the instabilities near cyclotron harmonics when the wave number is large. The transition from continuous to discontinuous spectrum is shown experimentally by varying the diameter of the electron beam.
NSA

N70-11901# Oak Ridge National Lab., Tenn.
EXPLOSIVE PLASMA INSTABILITIES
J. Fukai, S. Krishan, and E. G. Harris Aug. 1969 8 p refs Prepared jointly by Oak Ridge Natl. Lab. and Tenn. Univ., Knoxville
(Contract AT(40-1)-2598)
(ORNL-TM-2652)

The explosive instability caused by the nonlinear interaction of two positive energy waves and one negative energy wave and its stabilization by higher order nonlinear effects is described.
Author (NSA)

N70-11902*# Stanford Univ., Calif. Dept. of Applied Mechanics.
THE EFFECT OF FINITE LARMOR RADIUS ON THE PERTURBATION FLOW MIXING OF A COLLISIONLESS PLASMA
Shigeki Morioka (NASA. Ames Res. Center) and John R. Spreiter [1968] 34 p refs
(Grant NGR-05-020-330)
(NASA-CR-106965) Avail: CFSTI CSCL 20I

The Chew - Goldburger - Low theory of a collisionless plasma, modified to include the effect of finite Larmor radius of the ion and the electron, is applied to a linearized problem of two-dimensional steady flow. The zeroth-order terms in the Larmor radius expansions of the velocity distribution functions of the ion and the electron are assumed to be anisotropic Maxwellian. The spatial development of a given velocity profile is investigated for flows with either crossed or aligned magnetic fields, and for various values of Mach number, Alfven Mach number, and anisotropic pressure ratios in the main flow.
Author

N70-11930*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COLLISION INTEGRALS FOR NONELASTIC PROCESSES IN PLASMA KINETIC THEORY
John R. Viegas Nov. 1969 59 p refs
(NASA-TN-D-5548) Avail: CFSTI CSCL 20I

Often in the treatment of plasma dynamic problems the effects of nonelastic encounters must be included. In this note collision integrals for nonelastic processes that are important in plasma kinetic theory are developed. The following nonelastic interactions associated with the electron Boltzmann equation are presented in detail: inelastic and superelastic encounters between electrons and neutral species, ionization and three body recombination encounters in which the third body is an electron, and photoionization and two body recombination encounters. In addition, collision integrals are given for some of the processes that affect the transfer equations of heavy particles (ions and neutrals) and photons. Included here are radiative excitation and deexcitation encounters. The compatibility of these collision integrals with the forms associated with the usual macroscopic rate equations are demonstrated.
Author

N70-11946*# Volt Information Sciences, Inc., Washington, D.C.
SOLUTION OF ONE CLASS OF MAGNETOHYDRODYNAMIC EQUATIONS WITH MAGNETIC FIELD AMPLIFICATION
A. V. Getling 25 Aug. 1969 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Fiz. (Moscow), v. 187, no. 2, 1969 p 301 - 304
(Contract NAS5-12487)
(NASA-CR-106811; ST-MHD-SP-10860) Avail: CFSTI CSCL 20I

A kind of dynamo theory that could come close to model oscillating hydrodynamic dynamos of interest is worked out. Among other applications, it is used in solar physics. To that effect, the investigation of what magnetic configurations the hydromagnetic activity of a convective cell leads if and when Coriolis forces are in action is demonstrated. The simplest model is resolved. Its interest resides in the fact that it may be easily extended from this simplest particular case to diversified situations with resembling velocity fields. These may in their turn be interesting for applications.
Author

N70-11953*# City Coll. of the City of New York.
CASCADE MECHANISM OF NONLINEAR INTERACTIONS BETWEEN MODES IN A TURBULENT PLASMA
C. M. Tchen Oct. 1969 15 p refs
(Grant NGR-33-013-034)
(NASA-CR-106909) Avail: CFSTI CSCL 20I

A hydrodynamic model of plasma turbulence is developed.

A cascade concept is utilized for the problem of closure, which is characteristic of any nonlinear system. The spectra of kinetic and electrostatic energies are investigated for both the collisional and collisionless cases. The anomalous diffusion, called Bohm diffusion, is also derived, and found to play an important role in the nonlinear transport properties of the energy flux across a potential spectrum. Author

N70-12084# Stanford Univ., Calif. Inst. for Plasma Research.
IONIZATION AND DRIFT WAVES IN A DISCHARGE PLASMA
A. J. Duncan and J. R. Forrest May 1969 5 p refs Presented at the 9th Intern. Conf. on Phenomena in Ionized Gases, Bucharest
(Contract AT(04-3)-326)
(SU-IPR-301; CONF-690803-9) Avail: CFSTI

The propagation of m = 0 symmetric modes on a 2-meter-long 1.25-cm-radius helium positive column in an axial magnetic field was studied. The existence of a backward ionization wave and a forward electron drift wave is discussed. A brief theoretical treatment is given. NSA

N70-12086# Stanford Univ., Calif. Inst. for Plasma Research.
INTERACTION IN BOUNDED BEAM-PLASMA SYSTEMS
S. A. Self and F. W. Crawford May 1969 5 p refs Presented at the 9th Intern. Conf. on Phenomena in Ionized Gases, Bucharest
(Contract AT(04-3)-326)
(SU-IPR-302; Conf-690803-12) Avail: CFSTI

Laplace's equation is used to describe surface waves in a bounded beam-plasma system. Dispersion relations were derived and analyzed for three different cases. NSA

N70-12090# Stanford Unov., Calif. Inst. for Plasma Research.
EXPERIMENTAL STUDY OF LOW FREQUENCY HELICAL WAVES IN A DISCHARGE PLASMA
A. J. Duncan, J. R. Forrest, F. W. Crawford, and S. A. Self May 1969 5 p refs Presented at the 9th Intern. Conf. on Phenomena in Ionized Gases, Bucharest
(Contract AT(04-3)-326)
(SU-IPR-300; Conf-690803-8) Avail: CFSTI

Experimental results for the first helical mode at a low-pressure mercury-vapor discharge are compared with theoretical predictions. The onset of spatial growth in this mode at low magnetic fields (approximately 30 gauss) is confirmed, and the relation between this mode and self-excited instabilities is discussed. NSA

N70-12098*# Institute for Advanced Study, Princeton, N. J.
SYSTEMS OF SELF-GRAVITATING PARTICLES IN GENERAL RELATIVITY
Remo Ruffini and Silvano Bonazzola (Rome Univ.) [1968] 68 p refs Sponsored jointly by ESRO and NASA
(NASA-CR-107073) Avail: CFSTI

A method of self-consistent fields is used to study the equilibrium configurations of a system of self-gravitating scalar bosons or spin 1/2 fermions in the ground state without using the traditional perfect fluid approximation or equation of state. A nonrelativistic Newtonian approximation is developed and the corrections due to special and general relativity explicitly pointed out. Both fermions and bosons, in the Newtonian nonrelativistic approximation, a solution exists for any number of particles and the solutions differ only by a scale factor. A critical mass of gravitational collapse is found for a system of N×(Planck mass/m) sq self-gravitating bosons in the ground state. It is shown that there exists an interaction between gravitational and spinor field but its magnitude is generally negligible. The problem of an elementary scalar particle held together only by its gravitational field is meaningless in this context. Author (ESRO)

N70-12239# Royal Aircraft Establishment, Farnborough (England).
EXPERIMENTAL RESULTS FROM A PULSED PLASMA ACCELERATOR WITH RAIL ELECTRODES
T. J. Punter Nov. 1968 60 p refs
(RAE-TR-68277) Avail: CFSTI

This report presents the results of experiments carried out on a pulsed plasma accelerator, with rail electrodes and driven by a capacitor discharge, to determine the nature of the acceleration mechanisms. The motion of the plasma was recorded optically and magnetically and a graph constructed to describe the plasma motion. The electrical characteristics of the capacitor discharge were also recorded. The results are discussed and some possible acceleration mechanisms suggested. Author (ESRO)

N70-12274*# Aztec School of Languages, Inc., Maynard, Mass.
BEHAVIOR PATTERNS OF ARTIFICIAL ION CLOUDS IN THE IONOSPHERE AND THE MAGNETOSPHERE [UBER DAS VERHALTEN KUENSTLICHER IONENWOLKEN IN IONOSPHAERE UND MAGNETOSPHAERE]
Manfred Scholer (Ph.D. Thesis) Washington NASA Nov. 1969 111 p refs Transl. into ENGLISH from German dissertation
(Contract NASw-1692)
(NASA-TT-F-12565) Avail: CFSTI CSCL 20I

The ambipolar diffusion of a cylindrical symmetric plasma cloud in a slightly ionized background with a homogeneous magnetic field is examined. The assumption is made that no exterior electric field is adherent, and no differentiation is drawn between the ions of the cloud and the ions of the background. The diffusion parallel to the magnetic field is studied as a special dimensional problem in this context. In addition, the deceleration process of an ionized cloud moving relative to magnetosphere plasma is investigated and it is shown that alternation of the tubular flow through the cloud in connection with the ionosphere is important for the deceleration process. The possible occurrence of instabilities during cloud movements is discussed. Equations of motion and continuity, and Maxwell equations are used to obtain the basic differential equation for the diffusion problem. This equation is linearized and, with the simulated density distribution, numerically integrated for potential determinations. A magnetohydrodynamic model is developed for the analysis of cloud kinetics and the effective conductivity of the ionosphere. M.H.E.

N70-12275*# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
LOW ENERGY PARTICLE FLUXES IN THE GEOMAGNETIC TAIL
Vytenis M. Vasyliunas Jun. 1969 51 p refs Presented at NATO Production and Maintenance of the Polar Ionosphere, Tretten, Norway, Apr. 1969 Submitted for publication
(Grant NGR-22-009-015)
(NASA-CR-106968; CSR-P-69-17) Avail: CFSTI CSCL 20I

The spatial distribution of low energy particles in the magnetosphere, the properties of low energy particle populations in the magnetotail, and the relation of the plasma sheet to the auroral oval are reviewed. A summary of theoretical and observational values and a bibliography of seventy-seven references are provided. M.H.E.

N70-12408# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ELECTRODE METAL EFFECTS IN A DEUTERIUM PLASMA Z-PINCH DEVICE
M. H. Dezey and H. L. L. van Paassen 8 Aug. 1969 17 p refs
(Contract F04701-69-C-0066)
(AD-693125; TR-0066(5220-50)-2; TR-0200(4220-50)-2; SAMSO-TR-69-230) Avail: CFSTI CSCL 18/1

The introduction of the hydrogen-gettering metals titanium and

zirconium in a paraboloidal plasma Z-pinch device has produced a substantial increase in the neutron yield. Yields up to 3 x 10 to the 10th power neutrons per shot have been obtained using titanium-tipped electrodes in deuterium gas with an 18 kJ-energy source. The effect of these metals in increasing the neutron yield is sensitive to the compression obtained in this pinch device. This effect is small or nonexistent in Z-pinch devices with cylindrical electrodes where the space between the anode and cathode is large in the region of the pinch. Author (TAB)

N70-12487# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.

STABILITY OF INHOMOGENEOUS PLASMAS

William M. Leavens and C. H. Love (ESSA, Boulder, Colo.) Jul. 1969 20 p refs

(AD-692675; DI-82-0876) Avail: CFSTI CSCL 20/9

The stability of realistic, inhomogeneous, plasmas with sheaths is studied by examining the interaction between an electron beam and the discrete, longitudinal, normal modes of a stable, Maxwellian plasma. A weak beam just displaces the discrete plasma eigen frequencies in a way depending on beam current and energy. For the first four eigenfrequencies we calculate omega-plane maps. Instability is confined to a few intermediate modes, and growth rates are not large. Author (TAB)

N70-12528# California Univ., Livermore. Lawrence Radiation Lab.

SIMULATION OF PLASMA MICROINSTABILITIES WITH SUPERPARTICLE COMPUTER MODELS

Jack A. Byers 18 Jul. 1969 18 p refs Presented at the Conf. on Computational Phys., Culham, England, 28 - 31 Jul. 1969 Submitted for publ. Sponsored by AEC

(UCRL-71636; CONF-690706-1) Avail: CFSTI

The use of superparticle computer models to simulate modes of plasma instability that are due to the loss cone nature of the particle velocity distribution common to magnetic mirror confinement is discussed. In general, one has to deal simultaneously with ion gyration motion perpendicular to B and electron motion along B, and ideally one would like to start from realistic equilibrium configurations with both density and magnetic field variations. An essential problem associated with the superparticle approach is tee greatly enhanced noise due to the small number of particles per Debye length. For infinite medium models, essentially noise-free starting conditions were created by loading the phase space in a precisely uniform way. A stable distribution will remain at roundoff level, with no tendency to establish a thermal fluctuation level. In addition, a nonlinear instability was observed. The aim is the simulation of the finite geometry mirror machine problem with a two species, two dimensional model encompassing density and magnetic field variations, and with the attendant particle and wave reflection at the mirrors. One step now being taken to simulate finite geometry effects is a one species two dimensional model to set up the ion bouncing motion between mirrors in a noise free equilibrium. Author (NSA)

N70-12536# Los Alamos Scientific Lab., N. Mex.

APPLICATION OF GAS LASERS TO ELECTRON DENSITY MEASUREMENTS IN PLASMA

Zbigniew Rozkwitalski Jul. 1969 22 p refs Transl. into ENGLISH from Postepy Fiz. (Warsaw), v. 19, no. 4, 1968 p 383 - 401

(LA-TR-69-12) Avail: CFSTI

A review of methods for measuring electron density in plasma, with the application of gas lasers, is given. Theoretical fundamentals of the method based on the Faraday effect in plasma and some examples illustrating the use of infrared lasers are presented in the first part. A comprehensive discussion of interferometric methods is presented. The influence of electrons, atoms, and ions on the optical refractivity of plasmas is examined. Along with the discussion of applicability of conventional interferometers furnished with laser light sources, a detailed description of new laser interferometers is given, in which the properties of optical resonant cavities are utilized. Such an interferometer is composed of a He - Ne laser with the hemispherical cavity and of an additional external cavity coupled with the laser cavity. The examined plasma may be located either inside the additional passive cavity or inside the active laser cavity. NSA

N70-12538*# Institute for Advanced Study, Princeton, N. J.

SYSTEM OF SELF-GRAVITATING BOSONS

Remo Ruffini [1968] 10 p refs Presented at the 5th Intern. Conf. on Gravitation and Gen. Relativity, Tbilisi, USSR, Sep. 1968 Submitted for publication Sponsored jointly by ESRO and NASA (Grant NSF GP-7669)

(NASA-CR-107152) Avail: CFSTI CSCL 20H

The problem of possible equilibrium configurations of a system of many self-gravitating bosons in their ground state (temperature zero) is examined. The system of many particles in a Hartree-Fock type approximation is used instead of the concept of an equation of state. The problem is approached with a Newtonian approximation and then given full relativistic treatment. It is found that Tl1 sub 1 X95 Tl2 sub 2 = Tl 3 sub 3. A critical mass of gravitational collapse is found for a system of N = (Planck mass/m) sub 2 self-gravitating bosons in the ground state, where 'm' is the mass of the typical boson under consideration. Author (ESRO)

N70-12560# Transtek Associates, Reading, Mass.

THEORY OF TRANSPORT PHENOMENA IN A PLASMA IN A STRONG MAGNETIC FIELD

V. A. Baklunov et al Jan. 1969 9 p refs Transl. into ENGLISH from Russian Report NP-17761 Prepared for Princeton Univ. (Contract AT(30-1)-1238)

(MATT-Trans-85; NP-17761) Avail: CFSTI

The five-moment approximation of the Grad method is used for obtaining the transport equations in a completely ionized plasma in a strong magnetic field when the Debye screening radius turns out to be greater than the Larmor electron radius. NSA

N70-12564# Sandia Corp., Albuquerque, N. Mex.

SIMPLE DIFFUSION ANALYSIS OF HELIUM RELEASE EXPERIMENTS

Walter A. Stark Aug. 1969 26 p refs Presented at PuO2 Helium Release Inform. Meeting, Germantown, Md., 7 Aug. 1969 Sponsored by AEC

(SC-DC-69-1954; CONF-690809-1) Avail: CFSTI

Using a simple model, diffusion coefficient for helium gas in PuO2 plasma-torch fired microspheres have been extracted from helium release measurement data. The release mechanism is assumed to be simple diffusion in homogeneous spheres of a single size. The diffusion coefficients obtained show a temperature dependence that can be approximately fit with a two-term diffusion coefficient; however, the data show much scatter. Certain features of the release behavior indicate that the diffusion mechanism assumed here is being modified by other factors. Some speculations are offered as to the nature of these complicating factors. Author (NSA)

N70-12634# International Centre for Theoretical Physics, Trieste (Italy).

ELECTROMAGNETIC CONTRIBUTIONS TO THE CHARGE ASYMMETRY IN THE SEMILEPTONIC DECAYS OF NEUTRAL KAONS

C. Ryan (Univ. Coll. Dublin) Aug. 1969 25 p refs Submitted for publication

(C/69/92) Avail: CFSTI

While the measured charge asymmetry in the semileptonic

decays of neutral kaon is clear-cut evidence of CP violation in these processes, the detailed theoretical interpretation of this result is somewhat complicated by the presence of electromagnetic effects. It is shown that these electromagnetic effects can produce sizeable differences in decay distributions for decays into charge conjugate states. Author (ESRO)

N70-12643# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
STABILITY OF INHOMOGENEOUS HOT PLASMA FLOW
I. S. Baikov [1968] 16 p refs Transl. into ENGLISH from Russian Report NP-17656
(AEC-Tr-7053; NP-17656) Avail: CFSTI

The kinetic theory of steady laminar flow of inhomogeneous plasma along a magnetic field is discussed. It is shown that under phase resonance conditions, between the rate of the flow and the acoustic or drift wave, new instabilities appear in plasma caused by the flow rate gradient. The instability increment can exceed considerably the frequencies of plasma drift oscillations. Author (NSA)

N70-12650# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati.
INTERACTION OF SHORT LASER PULSES WITH SOLID MATERIALS
A. Caruso and R. Gratton Feb. 1969 20 p refs Sponsored by EURATOM
(LGI-69/1) Avail: CFSTI

The plasma production from a solid by means of an energetic short light pulse is studied theoretically. It has been found that the irradiation of a massive target results in the production of a hot spot with a lifetime comparable to the equipartition time of the energy between electrons and ions. The conditions for an efficient heating of small pellets are given. Some reasons for the absorption of the light in a collisionless regime are considered. Author (ESRO)

N70-12652# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati.
EFFECT OF NON UNIFORM ELECTRIC FIELDS ON DRIFT INSTABILITIES
M. Dobrowolny Apr. 1969 25 p refs Sponsored by EURATOM
(LGI-69/3) Avail: CFSTI

A general equation describing drift instabilities in a low beta plasma, in the presence of non uniform electric fields perpendicular to the magnetic field, is derived using a guiding center fluid picture for the ions and the drift kinetic equation with a Krook-like collision term for the electrons. Both the collisionless and the collisional regime and therefore also the transition between them can thus be described starting from the same equation. The equation is discussed and the influence of the electric field studied in the framework of a local approximation. Author (ESRO)

N70-12655# Academy of Sciences (USSR), Moscow.
PARAMETRIC EXCITATION OF SURFACE OSCILLATIONS IN A PLASMA IN THE PRESENCE OF AN EXTERNAL HIGH FREQUENCY FIELD
Yu. M. Aliev and E. Ferlenghi Frascati Lab. Gas Ionizzati Apr. 1969 16 p refs
(LGI-69/4) Avail: CFSTI

From the hydrodynamic and Maxwell's equations a system of equations that describes the linear oscillations of a bounded plasma situated in an external high frequency field is derived. From this system of equations the dispersion relation for electrostatic surface oscillations in the case of a plane layer and that of a cylindrical plasma is obtained. It is shown that new branches appear in the spectrum of surface oscillations when the plasma is situated in an external high frequency field. For a large range of frequencies of the external field, these surface oscillations turn out to be unstable. Author (ESRO)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N70-11418# Hughes Research Labs., Malibu, Calif.
SELECTIVE DOPING OF PIEZOELECTRIC CRYSTALS BY ION IMPLANTATION Semiannual Report, 1 Jan. - 30 Jun. 1969
G. A. Shifrin, K. R. Zanio, D. M. Jamba, W. R. Jones, and O. J. Marsh Aug. 1969 53 p refs
(Contract N00014-69-C-0171)
(AD-693154) Avail: CFSTI CSCL 20/12

The feasibility of creating n-type conducting regions in piezoelectric crystals by ion implantation is being investigated. Experimental studies have been performed with crystals of CdS and ZnO, and dopant ions of H, B, F, Al, Cl, and Ga. To date, both ZnO and CdS have been doped by ion implantation. The best success has been achieved with hydrogen in ZnO implanted at room temperature, in which an n-type conduction 1000 times stronger than the unimplanted portion was attained. Implantations of B, Al, Ga, F, and Cl in CdS have produced varying lesser degrees n-type conductivity, with Al the best. Range-energy calculations have been performed for the ion-substrate combinations of interest. A theoretical investigation of a piezoelectric surface wave propagation in the presence of an ion-implanted layer in a piezoelectric crystal substrate with the objective of application to amplification has resulted in a computer program which will be run in the second period of the program. Author (TAB)

N70-11427# Massachusetts Inst. of Tech., Cambridge. Energy Conversion and Semiconductor Lab.
ACTIVITIES CONCERNING ELECTRICAL, THERMAL, AND OPTICAL PROPERTIES OF SEMICONDUCTORS RELATED TO ENERGY CONVERSION Final Technical Report, 15 Jun. 1958 - 30 Nov. 1969
Richard B. Adler and Arthur C. Smith 1 Aug. 1969 31 p
(Contract Nonr-1841(51))
(AD-693235) Avail: CFSTI CSCL 20/12

The document presents a capsule view of work performed under the contract over its ten year period. It includes abstracts of all technical reports and theses, and bibliography of published works. Also included are types, dates, and personnel for all graduate degrees awarded, based upon theses carried out with contract support. Author (TAB)

N70-11431# Virginia Univ., Charlottesville. Research Labs.
OXIDE PLATELET FORMATION IN BULK TANTALUM
Dennis J. Kamp and Kenneth R. Lawless Sept. 1969 57 p refs
(Contract Nonr-474(11))
(AD-693545; MS-3531-109-69U) Avail: CFSTI CSCL 20/2

High purity 5 mil tantalum specimens were oxidized over the temperature range 500 to 700C in the pressure range 0.0005 to 0.05 torr oxygen. The oxidation was followed directly by joining an optical microscope and a vacuum heating stage. It was seen to proceed by the formation and growth of microscopic platelets which appeared as arrays of fine needles in the specimen surface. Samples were electropolished in a 90% H_2SO_4, 10% (by volume) solution at 10 volts potential. Foils were examined in both a Siemens 100 kV and RCA 500 kV electron microscope. A Cambridge

Steroscan scanning electron microscope (SEM) was used to study the surface topography of the oxidized samples. Transmission electron microscopy (TEM) and selected area diffraction (SAD) showed a cubic TaO(z) has formed on the (111) tantalum plane with the orientation relationship: (110) TaO(z) coplanar with the (111) Ta. A two-fold superlattice was seen to exist on the (001) Ta grains studied. SEM established that the platelets extended through the sample while TEM and optical methods independently indicate the platelets grew along certain well defined and unique crystallographic directions. Author (TAB)

N70-11465# Duke Univ., Durham, N.C. Dept. of Physics.
SPIN-LATTICE RELAXATION OF FE57 NUCLEI IN YTTRIUM IRON GARNET
Samuel M. Myers, Horst Meyer, and J. P. Remeika (Bell Telephone Labs., Inc., Murray Hill, N. J.) 25 May 1969 22 p refs
(Contract Nonr-1181(12))
(AD-693301) Avail: CFSTI CSCL 20/12

Pulse measurements of T1 for Fe57 nuclei in very pure, single crystals of YIG are reported. The temperature was varied from 2 K to 40 K, and the externally applied field ranged from 0 to 6000 Oe. The temperature variation of T1 is quite strong, being three orders of magnitude in the range 2-40K. At constant temperature, T1 changed approximately one order of magnitude between saturation field and 6000 Oe. The data are compared with the results of a calculation by Beeman and Pincus, in which a second-order Raman process is assumed to predominate in this temperature range. The presence of a relaxation mechanism associated with surface spin-wave modes is suggested. Author (TAB)

N70-11471# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
ELECTRONIC STRUCTURE AND OPTICAL SPECTRUM OF SEMICONDUCTORS Final Report, 1 May 1966 15 May 1969
Frank Herman, Richard L. Kortum, Irene B. Ortenburger, and John P. Van Dyke May 1969 42 p refs
(Contract F33615-67-C-1793)
(AD-692745; ARL-69-0080) Avail: CFSTI CSCL 20/12

During the past few years we have investigated the electronic energy band structure and related optical properties of over 50 crystalline solids, including the diamond-type crystals; cubic and hexagonal SiC; several III-V, II-VI, and I-VII compounds having the sphalerite or wurtzite structure; a number of IV-VI, II-VI, and I-VII compounds having the rock-salt structure; some anti-fluorite-type II-IV compounds; and a few solid rare gases; among others. During this period, a large number of papers were published dealing with various aspects of the work. As these papers have appeared in widely scattered scientific journals, conference proceedings, and books, we thought it would serve a useful purpose to bring all of them together under one cover, and have this collection serve as the main body of this Final Report. Also included in this Final Report are two earlier papers written in 1960 and 1964, which form the basis of our orthogonalized plane wave (OPW) energy band calculations. Author (TAB)

N70-11549*# Stanford Univ., Calif. Microwave Lab.
INVESTIGATION OF LASER DYNAMICS, MODULATION AND CONTROL BY MEANS OF INTRA-CAVITY TIME VARYING PERTURBATION Quarterly Status Report, 1 Aug. - 31 Oct. 1969
S. E. Harris Oct. 1969 28 p refs
(Grant NGR-05-020-103)
(NASA-CR-106836; ML-1801) Avail: CFSTI CSCL 20L

Generation, control, and stabilization of optical frequency radiation was studied in order to obtain tunable optical sources by means of nonlinear optical techniques. During this period work was active in the following areas: (1) a novel technique to produce long, high-power optical doubled pulses from Q-switched lasers; (2) a proposed new method which would allow the output frequency of an optical parametric oscillator to be locked to the absorption of an atomic transition; (3) a technique to attain backward oscillation in the far infrared; and (4) a method to stabilize gas lasers. Author

N70-11584# California Univ., San Diego. Dept. of Physics.
THEORY OF SOLIDS Final Technical Report, 1 Apr. 1960 - 31 Jul. 1969
Walter Kohn 4 Sep. 1969 12 p
(Contract Nonr-2216-(11))
(AD-693298; TR-58) Avail: CFSTI CSCL 20/12

The main subject areas covered under the contract are the following: Electronic phase transitions in solids; Theory of the inhomogeneous electron gas; Fermi surface images; Many electron effects in simple metals; and Disordered structures and metal defects. TAB

N70-11590# Notre Dame Univ., Ind. Coll. of Engineering.
MAGNETOMECHANICAL DAMPING IN Fe-10Co-5Al
Nicholas F. Fiore and H. V. Ganganna Aug. 1969 27 p refs
(Contract N00014-68-A-0152)
(AD-693644; THEMIS-UND-69-7) Avail: CFSTI CSCL 20/2

The damping of a Fe-10Co-5Al alloy has been measured as a function of frequency, amplitude, and applied magnetic field in an effort to determine whether its intrinsic damping might preclude its use as a magnetostrictive transducer material. Data are obtained at frequencies from 2.5 to 21.2 kilohertz and at fields to 1300 oersteds, with the specimen vibrating in the flexural mode. The flexural apparatus designed and used for the damping measurements has several unique features necessary for magnetic damping studies. Author (TAB)

N70-11633# Westinghouse Research Labs., Pittsburgh, Pa.
OPTICAL PROPERTIES OF 4H, 6H, 15R, 21R, CUBIC SiC
Wolfgang J. Choyke and Patrick Lyle 30 Apr. 1969 91 p refs
(Contract F19628-68-C-0272)
(AD-693653; AFCRL-69-0181) Avail: CFSTI CSCL 20/12

Optical absorption and reflectivity studies were carried out on a variety of cubic SiC samples. Two additional indirect transitions at 3.55 eV and 4.2 eV were found. In N-type cubic SiC the interconduction band transition X(1c) to X(3c) was accurately located. Results were compared with recent band calculations of Herman, Van Dyke and Kortum. Two additional papers were prepared dealing with a general discussion of the dependence of the physical properties on polytype structure and the optical properties of polytypes of SiC. Author (TAB)

N70-11654# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CAUSES OF NONUNIFORM DISTRIBUTION OF CHROMIUM IN RUBY
N. P. Tikhonova et al 20 Jun. 1969 8 p refs Transl. into ENGLISH from Optiko-Mekh. Prom. (Leningrad), v. 34, no. 7, 1967 45 48
(AD-693396; FTD-HT-23-301-68) Avail: CFSTI CSCL 20/2

The article deals with the cause of unequal distribution of chromium in crystals of ruby grown by the Verneuil method. It is established that the basic cause is the unequal burning out of the chromium from the charge in passing it through a flame. Author (TAB)

N70-11666# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF LASER RADIATION ON SEMICONDUCTORS
A. E. Gitlevich et al 4 Jun. 1969 9 p refs Transl. into ENGLISH from Fiz. i Khim. Obrabotki Materialov (USSR), no. 1, 1969 p 20 22
(AD-693281; FTD-MT-24-110-69) Avail: CFSTI CSCL 20/12

It has been established that intensive laser irradiation of materials causes the formation of surface craters, cracks and dislocations. This study is concerned with the effect of laser irradiation on semiconductors. Single crystals of Ge, Si, GaAs, GaP, InAs, and InSb were irradiated under an SU-1 ruby laser with light pulses of 5 Mu sec duration and 0.6 joule maximum energy. Microscopic studies of the irradiated specimens revealed that the laser beam caused formation of craters with smooth outlines, whose size and depth varied depending on the material. The largest diameter of 0.15 mm and depth of 50-60 Mu were found on the surface of InSb specimens. According to the size of their craters, the crystals can be arranged in descending order as follows: InSb, InAs, Ge, Si, and GaP, which is consonant with the melting points of the above materials. Author (TAB)

N70-12228# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.

STUDY OF POINT DEFECTS PRODUCED BY IRRADIATION OF MONOCRYSTALLINE NICKEL AND POLYCRYSTALLINE GADOLINIUM [ETUDE DES DEFAUTS PONCTUELS CREES PAR IRRADIATION DANS LE NICKEL MONOCRISTALLIN ET LE GADOLINIUM POLYCRISTALLIN]

Robert Cope (Ph.D. Thesis) Jul. 1969 55 p refs In FRENCH
(CEA-R-3854) Avail: CFSTI

A study of magnetocrystalline nickel by resistivity measurements is first made and resistivity and magnetic after effect measurements on an hcp ferromagnetic crystal other than cobalt, namely gadolinium are described. The existence of a small but definite orientation dependence in the creation of point defects by electron irradiation (20 K) of a nickel single crystal is demonstrated and the effect manifested in the form of the stage I sub C, II and III in the resistivity recovery. It was found that there is no magnetic after effect phenomenon in a neutron irradiated (27 K) ferromagnetic metal. Several considerations are discussed by a preliminary interpretation of this important difference between gadolinium and cobalt. Author (ESRO)

N70-12248# Royal Aircraft Establishment, Famborough (England).

CALCULATED EFFICIENCIES OF PRACTICAL GaAs AND Si SOLAR CELLS INCLUDING THE EFFECT OF BUILT-IN ELECTRIC FIELDS

S. Ellis and T. S. Moss Nov. 1968 48 p refs
(RAE-TR-68268) Copyright. Avail: CFSTI

The performance of GaAs solar cells has been calculated as a function of the doping levels, using practical values for the transport parameters. Calculations show that surface recombination is a more probable cause of the poor efficiencies obtained in practice than recombination in the junction region. Electric fields built into the cell by doping gradations may be used to reduce surface losses and produce an efficiency exceeding 20% for a surface recombination velocity of 1 million cm/sec. This figure allows for the finite resistance of the surface layer, the effect of which is considered in detail for several cases. Results for Si cells are also presented. These are well in accord with the values obtained in practice. For both materials consideration is given to the degradation brought about by particle bombardment. Author (ESRO)

N70-12309*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF SURFACE ACTIVE MEDIA ON FRICTION DEFORMATION, AND FRACTURE OF CALCIUM FLUORIDE

Donald H. Buckley Washington Dec. 1969 18 p refs
(NASA-TN-D-5580) Avail: CFSTI CSCL 07D

Sliding friction experiments were conducted on the (111) cleavage face of calcium fluoride single crystals in various environments including hexadecane, oleic acid, water, and dimethylsulfoxide. The results indicated that the friction and deformation behavior of calcium fluoride is extremely environment sensitive. The presence of the oleic acid and dimethylsulfoxide increased resistance to deformation of the calcium fluoride surfaces. The amount of deformation that occurred during sliding was strain rate sensitive; the higher the sliding velocity the lower the amount of surface deformation. The mechanical behavior of the surface was sensitive to extremely small concentrations of surfactant. Author

N70-12438# Brown Univ., Providence, R.I. Div. of Engineering.

SOME ELECTRICAL PROPERTIES OF Te FILMS AND Al-Al2O3-Te TUNNEL JUNCTIONS

V. Labunov and M. Kuhn May 1969 24 p refs
(Contract AFPA-SD-86)
(AD-693236; ARPA-E65) Avail: CFSTI CSCL 20/12

Tellurium evaporated onto pyrex substrates at room temperature is a polycrystalline p-type semiconductor with an energy gap equal to that for a single crystal Te. Its conduction properties are dominated by impurity band conduction with a mobility of 20 sq. cm/volt sec at room temperature and to carrier density of 10 ti the 18th power holes/cc. Current-voltage characteristics of Al-Al2O3-Te tunnel junctions cannot be interpreted in terms of simple tunneling models, but do indicate some band structure effects which are largely masked by the presence of excess currents. Author (TAB)

N70-12439*# American Univ., Washington, D.C. Solid State Group.

SOLID STATE GROUP Semiannual Report

30 Sep. 1969 13 p refs
(Grant NGR-09-003-014)
(NASA-CR-107019; SAR-1) Avail: CFSTI CSCL 20L

Research in the following projects is reported: (1) magneto-elastic spin Hamiltonians applied to garnets; (2) oscillatory magnetorestriction in multivalley semiconductors, with application to PbTe; (3) Neel ferrimagnets in large magnetic fields; (4) the relation of crystal groups to the macroscopic properties of solids; (5) collective electron theory of the metal-semiconductor transition in magnetite; (6) phase change in SnTe; (7) band crossing in PbxSn1-xSe; (8) Mossbauer studies of Ni-Pd alloys; and (9) Mossbauer effect in Heusler alloys. M.H.E.

N70-12465# George Washington Univ., Washington, D.C. Dept. of Engineering Mechanics.

ON THE CONTINUOUS DISTRIBUTIONS OF DISLOCATIONS

Galpi M. Arkilic and Douglas L. Jones Apr. 1969 23 p refs
(Grant AF-AFOSR-224-67)
(AD-692904) Avail: CFSTI CSCL 20/12

In order to obtain a better interpretation of the plastic behavior of crystalline materials, the contributions of the dislocation density tensor and dislocation loop density tensor are incorporated directly into the parameters of connection of non-Riemannian geometry. The nature of the plastic distortion tensor is re-examined to allow for independent contributions from Nyes dislocation density tensor and Kroupas dislocation loop density tensor. The effect of these tensors is then related directly to the parameters of the material connection by means of the plastic distortion. This procedure has the potential of allowing a more physical interpretation of the material connection since it is possible to determine experimentally Nyes and Kroupas density tensors. The effect of these in both microscopic and macroscopic coordinates is presented in this report. Author (TAB)

N70-12471# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.

BROADENING AND SHIFTING OF DIFFRACTION PROFILES FROM ANTI-PHASE DOMAIN BOUNDARIES OR STACKING FAULTS IN A B2 STRUCTURE

R. L. Rothman, R. Marion, and J. B. Cohen 1 Sep. 1969 18 p refs Submitted for publication

(Contract N00014-67-A-0356)
(AD-693201; TR-2) Avail: CFSTI CSCL 20/2

Planar faults produce unusual effects in diffraction patterns. Some peaks are broadened while others are not. Antiphase domain boundaries (APDB) as well as stacking disorders fall in this category, although they affect only the superlattice reflections significantly. For an L12 structure, Cu3Au for example, it has been known for years that APDB on (braces : 100) do not affect the 100 superstructure reflection in a powder pattern, but the 110 peak is broadened considerably. This phenomenon has been used in studies of the kinetics of domain growth and in investigations of the nature of deformation of Cu3Au. It is the purpose of this paper to derive the effects on the diffraction pattern of various stacking faults and APDB in a B2 structure, and to apply the results to an examination of the line broadening of filed AgMg.
Author (TAB)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N70-11947*# Aerojet-General Corp., Sacramento, Calif.
260-IN.-DIA MOTOR PROPELLANT IMPROVEMENT PROGRAM Final Report
B. A. Simmons and C. L. Rogers. Nov. 1969 254 p
(Contract NAS3-12002)
(NASA-CR-72621) Avail: CFSTI CSCL 21I

The process controls and propellant formulations which will assure sound propellant grains for very large motors were developed. Experiments included the casting of 10 42 in. (1.07 m) dia subscale molds and two full-scale molds simulating a segment of a 260 in. (6.6 m)-dia motor grain. Investigations included formulation, mixing, and casting variables. Grain defects were related to propellant flow behavior. Primary contributors to poor flow behavior were propellant ingredients and inadequate deaeration during mixing. Improved processes, an improved formulation, and process guidelines were developed and demonstrated to provide assurance of the capability for producing sound, high-quality grains.
Author

N70-12478*# Southwest Research Inst., San Antonio, Tex.
LOW-GRAVITY FUEL SLOSHING IN AN ARBITRARY AXISYMMETRIC RIGID TANK
Wen-Hwa Chu. Apr. 1969 34 p refs
(Contract NAS8-20290; SwRI Proj. 02-1846-02)
(NASA-CR-102361; TR-8) Avail: CFSTI CSCL 21I

Solutions to free and forced oscillations were found in terms of an auxiliary set of eigenfunctions. The slosh force and moment for an arbitrary axisymmetric rigid tank at arbitrary Bond number were derived for both pitching and translation and expressed in terms of characteristics of an equivalent spring-mass system. Numerical examples were constructed which compare favorably with available theories and experiments.
Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N70-11412*# Naval Air Propulsion Test Center, Philadelphia, Pa. Aeronautical Engine Dept.
ROTOR BURST PROTECTION PROGRAM Final Report
A. A. Martino and G. J. Mangano. Trenton, May 1969 118 p refs
(NASA Order DPR-R-105)
(NASA-CR-106801; NAPTC-AED-1901) Avail: CFSTI CSCL 21E

The NASA-sponsored rotor burst protection program reports its continuing study into the kinetics of intentionally failed rotors within fragment control systems and the influence of certain important system parameters on the containment/control process. High-speed photographs have recorded the complex action of bladed rotors which more closely approximate realistic turbomachinery operating conditions than did the earlier RBPP testing. The test observations should assist the containment design engineer. A survey of uncontained failures occurring in U. S. Commerical and Naval aviation experience is reported. A detailed study of commercial and military specifications regarding rotor integrity substantiation and containment criteria is presented.
Author

N70-11525# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
JET ENGINE NOISE SUPPRESSOR
L. I. Sorkin et al. 11 Jun. 1969 3 p Transl. into ENGLISH from Russian Patent no. 201101 (Appl. No. 947945/40-23, 22 Mar. 1965) 2 p
(AD-693531; FTD-HT-23-129-69) Avail: CFSTI CSCL 21/5

A brief description is given of a jet engine noise suppressor, which consists of a collector with nozzles and a feed line. To increase the noise suppression efficiency and reduce the engine thrust loss at the cruising regime, the collector nozzles for injecting secondary air jets or gas into the exhaust flow are mounted at the exhaust nozzle perimeter and are oriented in such a way that the direction of the secondary jets is perpendicular to the exhaust nozzle.
Author (TAB)

N70-11548*# Marquardt Corp., Van Nuys, Calif. Rocket Systems Div.
SPACE STORABLE THRUSTOR INVESTIGATION Final Report
C. D. Coulbert and R. J. FioRito. 11 Jun. 1969 195 p refs
(Contract NAS3-11215)
(NASA-CR-72526; FR-6147) Avail: CFSTI CSCL 21H

A design, fabrication, and experimental test firing program was conducted to demonstrate the feasibility of a radiation cooled, 100-pound thrust, liquid FLOX/methane, reaction control thrustor of advanced pyrolytic refractory composite materials. A matching high performance FLOX/methane injector was developed and long duration demonstration firings with chambers of pyrolytic refractory composites, pure copper, and high density graphite established the feasibility of the thrustor and injector design approaches which were selected. Data are presented on injector performance, thrustor material erosion rates, and carbon deposition characteristics.
Author

N70-11639# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPOSITE POWERPLANT HIGH-SPEED AIRCRAFT
Kuang-Hua Cheng. 16 Jul. 1969 8 p Transl. into ENGLISH from Hang Kung Chih Shih (Mainland China), no. 1, 1960 p 8 10
(AD-693529; FTD-HT-23-1145-68) Avail: CFSTI CSCL 21/5

For high-speed aircraft, it is sometimes desirable to install a combination of two different types of engines in order to offset the shortcomings of having only one type of engine. The paper first explains the three common types of engines of high-speed aircraft, including the turbojet engines, the ramjet engines, and the liquid rocket engines, pointing out the shortcomings of each type. The paper then outlines the advantages of combining two types of engines for one aircraft, making the two types of engines complement each others shortcomings. All the three combinations possible are

dealt with briefly. The drawback of using a combination of two engines is that the aircraft must carry the weight of two engines instead of one, thereby increasing the load of the aircraft. Author (TAB)

N70-11812# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD FOR PREVENTING VANADIUM CORROSION OF GAS TURBINE BLADES CAUSED BY LIQUID FUEL
R. A. Lipshtein et al 22 Apr. 1969 5 p refs Transl. into ENGLISH from the Russian Patent No. 191027 (Appl. No. 917965/23-4, 22 Aug. 1964) 1 p
(AD-693460; FTD-HT-23-1431-68) Avail: CFSTI CSCL 21/5

Anticorrosion additives for liquid fuels used to operate gas turbines having vanadium containing blades are ammonium phosphates or their substd. analogues. It was established that use of these additives stopped effectively vanadium corrosion of heat resisting steel up to 900C and ash content was also reduced. TAB

N70-11913*# Syracuse Univ. Research Inst., N.Y. Dept. of Mechanical and Aerospace Engineering.
NOISE GENERATION FROM INTERACTING HIGH SPEED AXISYMMETRIC JET FLOWS Semiannual Status Report, 1 Jun. 1968 - 31 Dec. 1969
Darshan S. Dosanjh, Amr N. Abdelhamid, and James C. Yu Jan. 1969 35 p refs
(Grant NGR-33-022-082)
(NASA-CR-107012; ME/Aerospace-1664-68-12-01; SASR-1) Avail: CFSTI CSCL 21E

Experimental investigations of the far field noise from interacting coaxial jet flows have been conducted in an anechoic chamber. The coaxial nozzle arrangement consisted of a convergent-divergent conical nozzle for the inner flow and a convergent annular nozzle for the outer flow. Experiments with two modes of nozzle operation were undertaken. Shadowgraphs of the coaxial jet flows were recorded in an attempt to relate the changes in flow pattern and shock structure to the observed variations of noise emission. These showed that flow pattern and shock structure of the coaxial interacting jet flows were extensively different from those of the main jet alone. The observed shock structure changes are most likely due to the oblique impingement of the control flow on the main jet flow boundary and can be predicted using the method for predicting the shock structure in two dimensional or axisymmetric transversely impinging jet flows. Author

N70-12050*# TRW Systems Group, Redondo Beach, Calif.
THROTTLEABLE THRUSTOR SYSTEM Quarterly Progress Report, 28 Jun. - 28 Sep. 1969
20 Oct. 1969 252 p Prepared for JPL
(Contracts NAS7-100; JPL-952344)
(NASA-CR-106988; TRW-69-4726-3-86; QPR-2) Avail: CFSTI CSCL 21H

The candidate design concepts previously selected were further analyzed for engine performance, flow control requirements and total system weight. The relative advantages of each configuration were evaluated based on the ground rules established previously for a typical Mars lander mission. Engine thrust levels of 300, 600 and 1200 lbf were considered and the optimum chamber pressure and expansion ratio were determined for each system. One system employing a light-weight catalytic chamber and conventional nozzle was recommended. This design incorporates an electromechanical throttle valve which is a high response version of a currently available valve. From the results of the system weight studies, the optimum design will employ a low chamber pressure and low expansion ratio. Author

N70-12102*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF ASTM-A1 AND NATURAL GAS FUELS IN AN ANNULAR TURBOJET COMBUSTOR
Donald F. Schultz, Porter J. Perkins, and Jerrold D. Wear 20 Oct. 1969 27 p refs
(NASA-TM-X-52700) Avail: CFSTI CSCL 21H

A preliminary study was made to determine possible problem areas in the use of natural gas fuel in aircraft turbojet combustors. A combustor designed for Mach 3.0 cruise operation with liquid ASTM-A1 fuel was operated with natural gas. The only change made to the combustor was in the fuel nozzle itself. Only one natural gas fuel nozzle design was used for these tests. Combustion efficiency, outlet temperature profiles, blowout and relight characteristics, flame radiation and smoke emission data were obtained. A comparison was made with data obtained from the same combustor using liquid ASTM-A1 fuel. The major problems encountered with natural gas were poor ignition and blowout characteristics. Author

N70-12399# Sandia Corp., Albuquerque, N. Mex.
SNAP-27 FUEL CAPSULE ASSEMBLY RADIANT HEAT TESTS
L. L. Keller, Jr. Mar. 1969 31 p Sponsored by AEC
(SC-DR-69-60) Avail: CFSTI

Three reference design full scale SNAP-27 fuel capsule assemblies were subjected to thermal pulses in radiant heat arrays to investigate their reaction to a fireball/afterfire resulting from launch pad abort, and an earth orbit decay for both lateral spinning and side-on stabilized modes. Photographs of the test setups and pertinent test data are presented. Author (NSA)

N70-12433# Oak Ridge National Lab. Reactor Div.
SUPERTOG: A PROGRAM TO GENERATE FINE GROUP CONSTANTS AND P SUB n SCATTERING MATRICES FROM ENDF/B
R. Q. Wright, N. M. Greene, J. L. Lucius, and C. W. Craven, Jr. Sep. 1969 86 p refs Sponsored in part by DASA
(Contract W-7405-eng-26)
(AD-693232; ORNL-TM-2679) Avail: CFSTI CSCL 20/8

SUPERTOG is a program to generate fine-group parameters and group-to-group scattering matrices using basic ENDF/B cross section data. A calculation to generate resonance data which uses single level Breit-Wigner resonance parameters is included in the code. The energy group structure, the order of cross section expansion, and the spectral weighting function are arbitrary and can be specified by the user. Data can be generated in forms for use in the GAM-I, GAM-II, ANISN, and DOT programs. Auxiliary programs are available for obtaining library tapes for XSDRN. Author (TAB)

N70-12537*# Boeing Co., Huntsville, Ala. Aerospace Group.
STUDY OF STRUCTURAL-THERMAL INSULATION-METEOROID PROTECTION INTEGRATION
D. W. Cornett and W. H. Armstrong 15 May 1969 64 p refs
(Contract NAS8-21430)
(NASA-CR-102364; D5-17525) Avail: CFSTI CSCL 21H

This report contains a study conducted to assess the feasibility of satisfactorily integrating the qualities of structural integrity, low thermal conductivity, and resistance to meteoroid penetration into a common tank wall. The results indicate that these qualities can be integrated into a thick composite consisting of alternating layers of load-carrying sheets and spacer material; however, suitable materials having as low a thermal conductivity as is required are not presently available. Defining a conventional concept to consist of a two sheet meteoroid shield and thermal insulation superimposed upon a basic tank wall and assuming that all desirable materials are available for an integrated concept, this study indicates that a weight savings as high as 50 percent over the conventional concept can be realized when using an integrated concept. Author

N70-12566# Aerospace Corp., El Segundo, Calif. Plasma Research Lab.
LABORATORY TESTING OF THE SPACE-CHARGE-SHEATH ELECTRIC THRUSTOR Technical Report, Jan. - Dec. 1968
Rudolf X. Meyer 31 Jul. 1969 24 p refs Revised
(Contract F04701-69-C-0066)
(AD-692736; TR-0066(5220-01)-1; SAMSO-TR-69-229) Avail: CFSTI CSCL 21/3

Recent experimental results obtained with a laboratory model of the space-charge-sheath thrustor are reported. The principal feature of this thrustor is the electrostatic acceleration of ions in a space-charge-sheath formed on the ionizer. Operating conditions were a specific impulse of 2700 to 5500 sec, a magnetic field strength of 800 to 2500 G, an accelerating gap of 1 to 3 mm, an ionizer surface if 13.8 sq cm, a cesium vapor pressure of 5 to 40 mm Hg, and an ion-beam current density of 4 to 14 m A/sq cm. The resulting ion-beam was surprisingly well collimated, with an estimated half-angle of 1.5 deg. Under best operating conditions, the electron drain current to the anode ionizer was 31% of the total current. Author (TAB)

N70-12600*# Wyle Labs., Inc., Huntsville, Ala. Research Div.
SPECTRAL TECHNIQUES IN JET NOISE THEORY
S. P. Pao and M. V. Lowson Apr. 1969 71 p refs *Its* Copy 8
(Contract NAS8-21060)
(NASA-CR-102370; WR-68-21) Avail: CFSTI CSCL 21H

Spectral analyses techniques are applied to Lighthill's aerodynamic sound equation to derive a unified jet noise theory, in which shear noise, self noise, and nonisentropic effects are treated on the same basis and derived simultaneously. The result of this theory has a simple representation of the radiated sound field. The structure of the source terms in the turbulence and the mechanism of noise generation are examined. Numerical examples of noise prediction are computed for two jet configurations where model turbulence structures are assumed. These examples demonstrate that this theory can predict correct sound pressure levels for a jet without any arbitrary constant. Author

N70-12624*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLUIDIC PROPORTIONAL THRUSTER SYSTEM Patent Application
Dean M. Chisel, inventor (to NASA) Filed 3 Apr. 1969 19 p
(NASA-Case-ARC-10106-1; US-Patent-Appl-SN-812998) Avail: CFSTI CSCL 21H

A proportional thruster system utilizing a fluidic vortex apparatus is proposed as means for controlling the continuous flow of gases supplied to a plurality of thrusters in response to detected vehicle attitude error signals. Continuous variable thrust for attitude control applications is provided by the flow of gas to a plurality of thruster nozzles through modulated vortex elements. The thruster system is responsive to electronic or fluidic sensed attitude error, sensors, and logic. NASA

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N70-11630# Johns Hopkins Univ., Baltimore, Md.
UPPER ATMOSPHERE ION MOLECULE REACTIONS Final Report, 1 Sep. 1963 - 31 Aug. 1968
Walter S. Koski 1969 67 p refs
(Contract AF 49-638-1301)
(AD-692957; AFOSR-69-2183TR) Avail: CFSTI CSCL 4/1

Using a comparatively unique facility consisting of a tandem mass spectrometer and associated equipment ion-molecule reactions expected to occur in the upper atmosphere have been investigated. The studies included hydrogen, carbon, oxygen, nitrogen and rare gas ions with molecular and rare gas constituents in the atmosphere. The charge transfer cross sections for a single electron transfer to a doubly charged ion for several reactions were measured. The energy range covered was 1 keV-8 keV. The reactions of the rare gas ions helium, neon, argon, krypton, xenon with ammonia were observed. The fractional yields and the relative cross sections for rare gas ion reactions with ammonia were determined for the 3 eV to 200 eV energy region. The argon-hydrogen deuterium ion reaction was studied and the results published. Absolute cross sections and kinetic isotope ratios for the dissociation of the hydrogen-deuterium ion into protons and deuterons when striking helium, neon, argon, krypton and xenon were investigated up to 50 eV incident kinetic energy. The calibration of the mass spectrometer is described in detail. Included are reprints of the author's published work. Author (TAB)

N70-11776*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE ANOMALOUS COMPONENT OF ATMOSPHERIC MUONS
Kaichi Maeda Nov. 1969 10 p refs
(NASA-TM-X-63740; X-641-69-491) Avail: CFSTI CSCL 04A

An alternate interpretation of the recent underground muon data is presented. This interpretation, which does not invoke an anomalous component of atmospheric muons produced by the so-called X-process, attempts to resolve discrepancies existing between the previous and the latest Utah results, as well as those with data from the underground experiments at Kolar. Author

N70-11845*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIAL GRADIENTS AND ANISOTROPIES OF COSMIC RAYS IN THE INTERPLANETARY MEDIUM
L. A. Fish and W. I. Axford (California Univ., San Diego) Nov. 1969 28 p refs
(NASA-TM-X-63743; X-611-69-505) Avail: CFSTI CSCL 04A

Approximate equations which describe the behavior of cosmic rays in the interplanetary medium under suitable conditions are used to make comparisons between observations and theoretical predictions of radial gradients and radial anisotropies. In the high energy region there appear to be no inconsistencies between theory and observations. In the low energy region, it is shown that theoretical predictions of the radial anisotropy expected from large radial gradients of the intensity are not inconsistent with observed radial anisotropies. However, in the latter case there are other inconsistencies, which suggest that some aspects of the observations or of the theory (or both) are unsatisfactory. Author

N70-12021*# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
MATHEMATICAL MODELS OF MAGNETOSPHERIC CONVECTION AND ITS COUPLING TO THE IONOSPHERE
Vytenis M. Vasyliunas Sep. 1969 30 p refs Presented at Earth's Particles and Fields, Santa Barbara, Calif., Aug. 1969 Submitted for publication
(Grant NGR-22-009-015)
(NASA-CR-106964; CSR-P-69-24) Avail: CFSTI CSCL 04A

A theoretical model of some aspects of magnetospheric convection and its effects on charged particle populations is discussed. A simple model was constructed postulating a primary flow away from the sun over the polar cap, and considering only the effects of the ionosphere. This model is considered to predict the observed location of the plasmasphere bulge, and reproduces the main features of the DS current system. F.O.S.

N70-12024*# Boeing Co., Seattle, Wash.
STUDY OF RADIATION HAZARDS TO MAN ON EXTENDED NEAR EARTH MISSIONS
S. B. Curtis (Calif. Univ.), W. R. Doherty, and M. C. Wilkinson
Washington NASA Dec. 1969 66 p refs
(Contract NASw-1362)
(NASA-CR-1469; D2-114299-1) Avail: CFSTI CSCL 04A

The particle types and energies which are important in the evaluation of the radiation hazard on long manned missions inside the earth's magnetosphere are identified. Spectra of the trapped protons and electrons encountered at synchronous altitude and in a 260 nautical mile, 50 deg inclination circular orbit are presented, along with estimates of the uncertainties. These spectra have been used to determine depth-dose curves behind typical aluminum shielding. Recent high energy data were used to evaluate the importance of the high energy (400 MeV to 2000 MeV) protons in the galactic and solar cosmic ray spectra in producing dose. The secondary dose components from 300 MeV/nucleon neon ions in water were estimated using cosmic ray emulsion data.
Author

N70-12128# Joint Publications Research Service, Washington, D.C.
STUDIES OF COSMIC RAYS, INTERPLANETARY MEDIUM AND MAGNETOSPHERE
In its Upper Atmosphere and Space Res. in the USSR in 1968 1 Aug. 1969 p 8-22 (See N70-12126 02-30)
Avail: CFSTI

Measurements of the energy spectrum of all cosmic ray particles made by Proton space stations were analyzed; results indicated a change in chemical composition of cosmic rays in the high-energy region in the direction of a predominance of heavy nuclei. Also noted was a slight increase in effective cross sections of inelastic collisions of protons and atomic nuclei in the higher energy region. Statistical correlation developed that the spectra of heavy and superheavy nuclei, as well as the spectra of helium nuclei were the same. Preliminary results on global gamma flux intensities showed an increase of intensity in those regions where clusters of galaxies exist; the gradient of galactic cosmic rays depended on the relative intensity of cosmic rays. Further reported were studies on the nuclear component of primary cosmic rays, the physics of the earth's magnetosphere, micrometeor and electron concentrations, plasma measurements by particle traps, and measurements of photoelectrons in low and middle latitudes. G.G.

N70-12175*# IIT Research Inst., Chicago, Ill.
ANALYSIS OF CORONAL LINE PROFILES Final Report
Robert W. Deuel May 1969 49 p refs
(Contract NASr-65(24))
(NASA-CR-107028; IITRI-V6000) Avail: CFSTI CSCL 04A

An experiment which used a Fabry-Perot interferometer instrument to measure Fe XIV emission line profiles at 5303 A in the solar corona is described. The area of observation was chosen from reports of maximum green line emission measured with the patrol coronagraph. Measurements were made in radial increments as far as the telescope's field of view permitted. The data were analyzed by a computer reduction program which accounts for scale changes associated with temporal instability, modifies the disk-observed background spectrum to coincide with the coronal background, and performs a subtraction to obtain an observed emission profile. This profile is corrected for the fore filter transmission characteristics and fit to a standard curve. The resulting profile halfwidth is converted to Doppler temperature assuming pure thermal broadening. The results are presented as relative intensity of the observed coronal emission, source halfwidth, and Doppler temperature for each solar position angle and radius observed.
Author

N70-12184*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Solar Observatory.
A CORRELATION OF OPTICAL, RADIO, AND INTERPLANETARY RECORDS OF SOLAR EVENTS Final Report
Sara F. Smith and Karen L. Angle Jun. 1968 50 p refs
(Contract NASw-1690)
(NASA-CR-107027; LSMC-687340) Avail: CFSTI CSCL 04A

The observations of some significant details of flares which have received insufficient attention and which are critical to the understanding of solar flares are described. Attempts to relate these details to specific characteristics of X-rays, radio bursts and, to a lesser extent, particle events are discussed. It is suggested that (1) waves and rapid visible ejections from solar flares may be associated with delayed particle events and Type II bursts, and (2) the development of flare points may be associated with prompt particle events and Type III bursts.
Author

N70-12188# Institut d'Aéronomie Spatiale de Belgique, Brussels.
ATOMIC OXYGEN INFRARED EMISSION IN THE EARTH'S UPPER ATMOSPHERE
G. Kockarts and W. Peetermans 1969 32 p refs Submitted for publication *Its* Aeronomica Acta No. A-63-1969
Avail: CFSTI

The atomic oxygen emission at 63μ is analyzed between 50 km and 250 km for several atmospheric models. The frequency integrated intensities and the volume emission rates are computed and discussed in connection with experimental and theoretical investigations of the atomic oxygen distribution. It is shown that radiative transfer should be used below 150 km. If an infrared emission occurs near the tropopause, the radiative transfer solution lead to an infrared heating near the mesopause. A reduction factor is introduced for comparison with an optically thin atmosphere.
Author (ESRO)

N70-12212# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
SOME WAYS TO INVESTIGATE THE SOLAR MODULATION OF COSMIC ELECTRONS [MOYENS D'ETUDE DE LA MODULATION SOLAIRE DES ELECTRONS COSMIQUES]
Jean-Pierre Mercier (M.S. Thesis) Sep. 1969 39 p refs In FRENCH
(CEA-R-3815) Avail: CFSTI

In this report are investigated the solar modulation of cosmic electrons in different ways: 1. by comparing the calculated intensity with the measured intensity of positons, the solar modulation of positons, hence the modulation of negatrons, can be evaluated since the modulation of negatrons is probably the same as for positons; 2. by comparing the electron spectrum in interstellar space needed to explain the galactic background radio emission with that observed near the earth, information about the modulation of electrons can be deduced; 3. the modulation through the observation of its variations during the solar cycle can be investigated. These different methods lead to compatible results. In spite of the fact that the precision of the experimental data is poor, the modulation can be represented by: a) a constant, or a form in exp (- K/Ro) under the rigidity Ro $\simeq$ 0.5 BV; b) a form in exp (- K/R) or exp (- K/R^2) above this rigidity. In addition, the investigation of both electrons and protons displays that the diffusion-convection theory is inadequate to explain all the features of the solar modulation.
Author (ESRO)

N70-12221*# Michigan Univ., Ann Arbor. Dept. of Astronomy.
OGO 3 DATA ANALYSIS: DYNAMIC SPECTRA OF SOLAR BURSTS Final Scientific Report
Thomas E. Graedel [1968] 74 p refs
(Grant NGR-23-005-312)
(NASA-CR-107031) Avail: CFSTI CSCL 04A

The computation of solar burst time profiles and dynamic spectra, utilizing a model of the form described, can produce theoretical values for Type 3 burst characteristics which agree quite

well with observational values. The parameters which have been used in the model can then be regarded as indicative of coronal physical conditions and of Type 3 solar burst radiation mechanisms. A high level of accuracy was obtained in matching observations, even though the model which was used did not treat the difficult plasma physics problems in a realistic way. The results presented refer to average Type 3 bursts. Any individual event is likely to result from an electron velocity spectrum which differs from the average, may occur with a density enhancement differing from the model described, etc. Author

N70-12287*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ELECTRON OBSERVATIONS BETWEEN THE INNER EDGE OF THE PLASMA SHEET AND THE PLASMASPHERE
M. A. Schield and L. A. Frank Aug. 1969 43 p refs
(Contract NAS5-2054; Grant NGL-16-001-002; Contract Nonr-1509(06))
(NASA-CR-106912; Rept-69-46) Avail: CFSTI CSCL 04A

Electron observations between approximately 100 eV and 50 keV are presented for L values between 3 and 10 R sub E (R sub E, earth radii) near local midnight at low magnetic latitudes. These measurements were obtained between June 9 and July 23, 1966, with electrostatic analyzers borne on OGO-3. The inner edge of the plasma sheet is characterized by a sudden exponential decrease in the electron energy density. This near earth decrease has a very distinct structure with fluxes of higher energy electrons decreasing further from the earth for electron energies between 750 eV and 20 keV. A trough of approximately 100 eV electrons with densities of approximately .001 cm is observed to fill the region between the inner edge of the plasma sheet and the plasmasphere. The density of electrons above 750 eV is often less than .0001 cm in this region. The separation between the inner edge of the plasma sheet and the plasmapause was between 1 and 3 R sub E in June and increased to between 3 and 5 R sub E in July. Analysis of subsequent data should determine whether this is a latitude or local time effect. Author

N70-12411# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
IONIZATION AND EXCITATION OF NITROGEN BY PROTONS AND HYDROGEN ATOMS IN THE ENERGY RANGE 1 – 25 KeV
R. J. Mc Neal and David C. Clark 1 Jul. 1969 29 p refs
(Contract F04701-69-C-0066)
(AD-693127; TR-0066(9260-01)-1; TR-0200(9260-01)-8; SAMSO-TR-69-273) Avail: CFSTI CSCL 4/1

Recent measurements of the energy spectra of protons and hydrogen atoms in breakup auroras have found significant fluxes at energies near 1 keV. Cross sections for ionization and light emission for collisions of protons and hydrogen atoms with atmospheric gases are useful in analysis of these auroral events. Atomic beam measurements are reported of ionization and charge-capture cross sections for proton bombardment N2, of ionization and stripping cross sections for hydrogen atom bombardment of N2, and of the relative cross sections for emission of N2(+) 391.4-nm radiation in collisions of protons and hydrogen atoms with N2 in the energy range 1-25 keV. Author (TAB)

N70-12550*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
ELECTRON PARTICIPATION PATTERNS AND THEIR RELATION TO SUBSTORM INCREASES IN 50 150 keV ELECTRONS AT THE SYNCHRONOUS ORBIT Cosmic Ray Technical Report
Lowell H. Rosen (M.S. Thesis) Aug. 1969 42 p
(Grants NGL-24-005-008; NSF GA-1508)
(NASA-CR-107162; CR-145) Avail: CFSTI CSCL 04A

Analysis of records from the seven station Alaskan Riometer Chain (L = 3.9 to L = 8.) shows that the median latitude location of the hard (above 40 keV) electron precipitation region extends from a low latitude edge (defined as maximum intensity/e) of L = 5 for all local times to a high latitude edge of beyond L = 8 during the morning and to between L = 6 or 7 during the afternoon. With the aid of the riometer chain, the poleward and equatorward progression in precipitation onset was studied. The poleward progression events were most frequently seen near local midnight, and on the average, the time lag for the events showing the equatorward progression increased with local time between midnight and noon. Comparisons of the electron precipitation events at the riometer chain with increases of electron fluxes at the ATS-1 synchronous orbit show that a good correlation in coincidence, intensity and latitude exists. The events used in this analysis indicate the source of much of substorm precipitation between 0400 and 1200 local time is an eastward drifting, dribbling electron cloud. However, for some substorms, acceleration occurring at all local times is not ruled out. Author

N70-12603# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE PENETRATION OF SOLAR WIND HYDROGEN TO 300 km Technical Report, Aug. 1968 – Jan. 1969
Gilbert Ialongo 1 Sep. 1969 42 p refs
(Contract F04701-69-C-0066)
(AD-693126; TR-0066-5260-20-3; SAMSO-TR-69-231) Avail: CFSTI CSCL 4/1

The penetration of the neutral component of the solar wind is analyzed as a function of depth of penetration in the earths magnetosphere and exosphere. The fast neutral H atoms collide with thermal H, He, N, O, and their ions and are partly changed into fast protons by charge-changing collisions. As the density of the ions and atoms surrounding the earth changes with local time, month, and year of observation, the attenuation of the energetic neutrals is a time-dependent phenomenon. Calculations were carried out for the year of the largest solar activity, and the results show that an equilibrium condition is reached in which the incident beam is less than 20% ionized. Conditions of near equilibrium are reached at altitudes of 320 km in the morning hours and 400 km in the afternoon hours. Author (TAB)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N70-11404*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
A FORCE-MEASUREMENT IN ORBIT TO CHECK SCALAR GRAVITATIONAL THEORY
John Hovorka Aug. 1969 29 p ref
(Contract NAS9-8328)
(NASA-CR-102005; RN-57) Avail: CFSTI CSCL 03B

This study concludes that the Brans – Dicke theory of gravitation cannot readily be checked by means of gravitational clock in eccentric orbit, even around Jupiter. Consideration is given to the use of a pendulous integrating gyro accelerometer to measure the force on an orbiting mass directly, to check the same theory. The fundamental difficulties of the clock experiment are compared with those of the accelerometer experiment. A valid earth orbital experiment with the latter appears at the present time to be a good possibility, and a procedure for following this up is recommended, including suggestions for a required accelerometer development. Author

N70-11414# Mitre Corp., Bedford, Mass.
MOTION SIMULATION OF GROUND OBSERVED EARTH SATELLITES
J. F. A. Ormsby Jun. 1969 29 p refs
(Contract AF 19(628)-2390)
(AD-693550; W-7289; ESD-TR-69-185) Avail: CFSTI CSCL 22/3

The paper discusses a simulation of the overall body motion characterized by the orbital and local motion about the center of mass. This motion is related to the observations made by ground stations and provides orientation of the total motion in the antenna axes systems and orientation of the lines of sight relative to the ground. Since only the basic characteristic motions are required and exacting simulation to some existing satellite is not necessary, certain simplifications are introduced. These include omission of perturbations and observational errors and the elimination of a true time requirement and a time based progression reference. The emphasis here is on a description of the equations, relations, and transformations of the simulation model. Author (TAB)

N70-11422# Harvard Coll. Observatory, Cambridge, Mass.
THEORETICAL INVESTIGATION INTO RADIATIVE TRANSFER AND HYDRODYNAMIC MOTIONS IN SPHERICAL STELLAR ATMOSPHERES, AND INTO STEADY SHOCK WAVES IN HYDROGEN Final Report, 1 Mar. 1964 - 30 Apr 1969
Charles A. Whitney Jun. 1969 16 p refs
(Contract AF 19(628)-3877)
(AD-693574; AFCRL-69-0272) Avail: CFSTI CSCL 3/2

Work under this contract considered a variety of subjects related to the influence of gas dynamic motions on the structure of stellar atmospheres. This report summarizes the topics and provides a guide to the bibliography, dividing the papers into the following categories: (a) Mathematical techniques, (b) Theory of line transfer, (c) Gas dynamics of stellar media, (d) The structure of the solar chromosphere. This work provides the theoretical basis for the systematic development of an increasingly important branch of astrophysics -- the gas dynamics of stellar media. Author (TAB)

N70-11436# California Inst. of Tech., Pasadena.
POLARIZATION OF PULSATING RADIO SOURCES (8)
R. D. Ekers and A. T. Moffet 1969 23 p refs *Its* Observations of the Owens Valley Radio Obs.
(Contract N00014-67-A-0094)
(AD-693053) Avail: CFSTI CSCL 3/2

The complete polarization characteristics of a number of pulsating radio sources have been determined at 13 cm. Both a stable average and a time varying component of the polarized radiation were found. A change in the position angle of the linear component during the course of the pulse is a common property; however the high degree of linear polarization and constant rotation of angle seen for PSR0833-45 is atypical. Author (TAB)

N70-11444*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
A STUDY OF EVALUATION TECHNIQUES FOR LUNAR SCIENCE Final Report
Oct. 1969 45 p refs
(Contract NASr-65(22); Proj. 16088)
(NASA-CR-106803) Avail: CFSTI CSCL 03B

An attempt is made to formulate a logic for quantifying the value of scientific measurements by using specific but representative examples. The two examples selected are (1) Is there active volcanism on the moon? and (2) Does the moon exhibit natural seismicity? The basic concept involved two major steps: (1) to express the scientific goals and objectives of exploration in terms of measurement requirements, and (2) to determine the relative worth of possible experiments in fulfilling the measurement requirements. Tables summarize the key relationships for the two examples considered. It is readily apparent that the final value equations are somewhat cumbersome. They do demonstrate the feasibility of mathematically expressing scientific value but they are difficult to derive and do not easily demonstrate all the functional dependencies between parameters. Author

N70-11473*# Raytheon Co., Sudbury, Mass. Equipment Div.
ELECTROMAGNETIC PROBING OF THE MARS AND VENUS ATMOSPHERES AND IONOSPHERES FROM AN ORBITING PAIR. VOLUME 2: APPENDICES Final Report, 19 Dec. 1968 - 19 Sep. 1969
19 Sep. 1969 331 p
(Contract NASw-1772)
(NASA-CR-106808; R69-4373-2) Avail: CFSTI CSCL 03B

Appendices presented contain computer programs and computational results from electromagnetic probes of Mars and Venus atmospheres, as well as from the ionosphere, that were performed by an orbiting satellite pair. G.G.

N70-11474*# Raytheon Co., Sudbury, Mass. Equipment Div.
ELECTROMAGNETIC PROBING OF THE MARS AND VENUS ATMOSPHERES AND IONOSPHERES FROM AN ORBITING PAIR, VOLUME 1 Final Report, 19 Dec. 1968 - 19 Sep. 1969
19 Sep. 1969 187 p
(Contract NASw-1772)
(NASA-CR-106809; R69-4373-1) Avail: CFSTI CSCL 03B

A computer simulation of orbiter-to-orbiter remote probing of planetary atmospheres and ionospheres by radio waves has been performed, considering as baseline experiment configuration the parameters of the Viking mission to Mars and adopting similar orbital assumptions for a Venusian pair of orbiters. Three-dimensional models have been constructed for the atmosphere and ionosphere of Mars and Venus, based on the latest experimental evidence, and inclusive of horizontal gradients of various steepness. Orbiter-to-orbiter dual-frequency columnar measurements have been simulated, with a radio path that sweeps altitude spans from orbital heights to zero. The profiles of the original model have been reconstructed by inverting the columnar data using Abel transform and model matching. It has been proven that spatial resolution with cell size of 600 km × 600 km × 1 km is achievable and that volumetric coverage of 90% of the atmosphere and ionosphere of the two planets can be performed with orbiting mission durations of approximately 180 days. Author

N70-11487*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE TEMPERATURE DISTRIBUTION IN THE SOLAR CHROMOSPHERE
Stuart D. Jordan Washington Nov. 1969 128 p refs
(NASA-TR-R-291) Avail: CFSTI CSCL 04A

A new approximate method is developed for calculating the temperature distribution in an atmosphere where local mechanical energy dissipation is balanced by local net radiative loss in one or more spectral lines for which the atmosphere is optically thick. The method uncouples the equations of radiative transfer for the individual spectral lines from the energy conservation equation and from each other. This permits a solution of each individual transfer equation for the radiation field in each line. These results, used in the energy conservation equation, yield the temperature distribution if the optical depth ratio of the spectral lines at each point is known. The method is applied to selected strong resonance lines in the solar chromosphere. Author

N70-11502# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
A SATELLITE OBSERVATION OF THE RELATIVISTIC DOPPLER SHIFT

R. E. Jenkins Mar. 1969 24 p refs
(Contract NOw-62-0604-C)
(AD-693044; APL-TG-1060) Avail: CFSTI CSCL 22/3

Relativity predicts a periodic variation in the observed frequency of satellite radio signals as the satellite moves from perigee to apogee in an eccentric orbit. This variation has been observed using the NASA sponsored GEOS-I satellite. The observation was made over a 4-day span using data obtained in 1966 by the TRANET doppler system. Author (TAB)

N70-11554# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 208
17 Jul. 1969 57 p refs Transl. into ENGLISH from various Russian articles
(JPRS-48434) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1–5 refs (See N70-11555 02-30)
2. METEOROLOGY p 6–15 refs (See N70-11556 02-20)
3. OCEANOGRAPHY p 16–28 refs (See N70-11557 02-13)
4. TERRESTRIAL GEOPHYSICS p 29–40 refs (See N70-11558 02-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 41–51 refs (See N70-11559 02-13)
6. MISCELLANEOUS p 52–57 refs (See N70-11560 02-30)

N70-11555# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 208 17 Jul. 1969 p 1–5 refs (See N70-11554 02-30)
Avail: CFSTI

Journal articles are summarized on astronomical observations and theory. Decimeter and centimeter radio propagation in the Venusian atmosphere was analyzed for the cases when the source is on the planet's surface and when it is moving close to the disk. Time variations of the mean annual values of sunspot groups total areas in different latitude intervals are discussed briefly for the period 1914-1953. Spectrograms of a bright prominence at the solar limb are described. An equidensitometric method is outlined for constructing isophots of large celestial bodies characterizing the photometric structure of the object. A mathematical model was developed to represent the velocity of gas and magnetic field motions in sunspots. The integration of differential equation of the relative motion of a point in a three body star problem was performed. Radio sources in the Milky Way were observed at a wavelength of 8.4 cm. The value of the magnetic contraction of sunspots was determined from data taken during the IGY. N.E.N.

N70-11560# Joint Publications Research Service, Washington, D.C.
MISCELLANEOUS Abstracts of Scientific Articles
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 108 17 Jul. 1969 p 52–57 refs (See N70-11554 02-30)
Avail: CFSTI

An interview with Academician Blagonravov on the Apollo program about three weeks prior to the Apollo 11 launching is presented in full. An abstract is also given of a study on trace and rare elements in the principal Soviet rivers. N.E.N.

N70-11576 † Purdue Univ., Lafayette, Ind.
[NISF-SUPPORTED RESEARCH] Progress Report
Frederik J. Belinfante 26 Aug. 1968 15 p refs
(Grant NSF GP-06517)
(PR-2) Avail: Issuing Activity

Discussions are reported on the best choice of a galactic object of nearly fixed luminosity, the standard candle in cosmology, and the quantum field theory of gravity interacting with fermions. Developmental efforts on measurement methods for magnitudes of galaxies in a cluster, and cosmological models which might better explain the observational data of many astronomers are mentioned. M.H.E.

N70-11612*# National Aeronautics And Space Administration, Manned Spacecraft Center, Houston, Tex.
A MINIMUM-ENERGY MISSION PLAN FOR THE MANNED EXPLORATION OF MARS
James J. Taylor and Sam W. Wilson, Jr. (TRW Systems Group, Houston, Tex.) Washington Nov. 1969 80 p refs
(NASA-TN-D-5502) Avail: CFSTI CSCL 03B

A minumum energy mission profile and launch window analysis for a manned exploration of Mars is evaluated for the period from 1977 to 1985. Four launches of an uprated Saturn 5 booster, each capable of placing a 400,000 pound payload into a 260 nautical mile orbit, are used to assemble the spacecraft and the trans-Mars injection stages. The launch window for the minimum energy mission is relatively insensitive to delayed launches or interrupted departure sequences. From technological considerations, the minimum energy mission is feasible and permits the accomplishment of an increased list of scientific objectives. Author

N70-11641# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 211
3 Sep. 1969 59 p refs Transl. into ENGLISH from various Russian articles
(JPRS-48735) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1–9 refs (See N70-11642 02-30)
2. METEOROLOGY p 10–16 refs (See N70-11643 02-20)
3. OCEANOGRAPHY p 17–24 refs (See N70-11644 02-13)
4. TERRESTRIAL GEOPHYSICS p 25–38 refs (See N70-11645 02-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 39–49 refs (See N70-11646 02-30)

N70-11642# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys. Astronomy, and Space, No. 211 3 Sep. 1969 p 1–9 refs (See N70-11641 02-30)
Avail: CFSTI

Recent achievements of the Byurakan Astrophysical Observatory are outlined, with mention made of the discovery of about 300 galaxies with unusually strong ultraviolet radiation, and confirmation of the idea that quasars are a definite stage in the development of galaxies. A theory on the formation of lunar features is discussed, based on the premise that plentiful water lying under a thin layer of the moon's soil exists, and that a special drainage shell is present deep within the earth and the moon. Summary information is provided on the temperature of cosmic radio emission in the decimeter range; optical properties of the Martian surface and atmosphere; radio emission of the pulsar CP-1919 in the meter wave range; radio wave absorption and

cosmic radio emission; brightness distribution over the Martian disk and its stellar magnitude; and source radio brightness distribution. M.G.J.

N70-11646# Joint Publications and Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 211 3 Sep. 1969 p 39–49 refs (See N70-11641 02-30)
Avail: CFSTI

The practical applications of space research are discussed, with particular reference to the Soviet meteorological satellite system and its value in storm predictions. An automatic method for correcting perspective distortions and the geographic tie-in of meteorological satellite television photographs is also discussed. In conjunction with the Soviet space television system, it is reported that more than 30 Orbita stations will be operational in 1969. The application of the limited modeling principle for laboratory simulation of space phenomena is described briefly, and examples of its use are given. Summary information is included on a method for map control of lunar satellite photographs, and on the use of radio pulse compression as a method of ionospheric sounding. M.G.J.

N70-11657*# Bellcomm, Inc., Washington, D.C.
LUNAR ATMOSPHERIC CONTAMINATION DUE TO AN APOLLO LANDING
G. K. Chang 16 Sep. 1969 19 p refs
(Contract NASw-417)
(NASA-CR-106916; TM-69-2015-5) Avail: CFSTI CSCL 03B

The lunar atmospheric contamination due to an Apollo mission is analyzed using a mathematically simplified diffusion equation. In view of the tenuous lunar atmospheric density, the mean-free-path for most gases is large; hence, one can only make a qualitative estimate at the vicinity of the LM. Qualitative results of the present study show that the contaminants are quickly dispersed from the lunar environment, when the loss factors given in the text are assumed. In less than 3 days (72 hours), the contaminant density is decreased to more than an order of magnitude below the estimated ambient atmospheric density. According to the Apollo Lunar Surface Experiments Program (ALSEP) affected by these contaminants. Consequently, the ALSEP Cold Cathode Gauge Experiment would not detect the LM exhaust gas of the same landing mission, but it may detect the contaminants from a subsequent landing mission. Author

N70-11671# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 209, 210
13 Aug. 1969 60 p refs Transl. into ENGLISH from various Russian articles
(JPRS-48606) Avail: CFSTI

CONTENTS:
1. ASTRONOMY p 1–8 refs (See N70-11672 02-30)
2. METEOROLOGY p 9–18 refs (See N70-11673 02-20)
3. OCEANOGRAPHY p 19–33 refs (See N70-11674 02-13)
4. TERRESTRIAL GEOPHYSICS p 34–36 refs (See N70-11675 02-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 37–50 refs (See N70-11676 02-30)

N70-11672# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 209, 210 13 Aug. 1969 p 1–8 refs (See N70-11671 02-30)
Avail: CFSTI

Soviet astronomical research articles are summarized. The topics of investigation cover the following areas: cosmology; solar flares and radio bursts; lunar topography, origin, and emissions; Venusian radius; and the energy levels of neutral iron. N.E.N.

N70-11676# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 209, 210 13 Aug. 1969 p 37–50 refs (See N70-11671 02-30)
Avail: CFSTI

Abstracts of news and journal articles on aerospace research and space vehicles are presented. The relationship between interplanetary plasma and magnetic field, observed by Venera and Mariner probes approaching Venus, is discussed, and possible explanations are given. Other topics include ionospheric propagation, electron and ion densities in the ionosphere and magnetosphere, effects of bodies moving in plasmas, cloud diffusion and morphology, solar illumination of earth satellites, satellite equilibrium, motion of an orbiting spacecraft with a tethered astronaut, and launching of Luna 15, Cosmos 288, and Cosmos 289. N.E.N.

N70-11729# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 205 4 Jun. 1969 p 1–19 refs (See N70-11728 02-13)
Avail: CFSTI

Astronomical articles are summarized emphasizing solar physics. Solar eclipses, wind rotation, radio emission, flares, and magnetic fields are briefly discussed. Radio emissions from Venus, Mercury, and interstellar space are also described, along with the ring formations on Mars and the Moon. Meteor disintegration, Leonid perturbed motion, and asteroid orbit calculations are considered. Methane absorption in Saturn's atmosphere, motion of Jupiter satellite, galactic nuclei, and interplanetary plasmas are also studied. N.E.N.

N70-11824*# Boeing Co., Seattle, Wash. Scientific Research Labs.
PHOTOMETRIC PROPERTIES OF SELECTED LUNAR FEATURES
R. W. Shorthill, J. M. Saari, F. E. Baird, and J. R. Le Compte Washington NASA Nov. 1969 414 p refs
(Contract NAS9-7665)
(NASA-CR-1429) Avail: CFSTI CSCL 03B

Photometric phase curves for 300 lunar sites were extracted computer from measurements made through a lunation at 23 phase angles. The brightness at each site was corrected to mean libration by performing a least squares fit of the Hapke theoretical photometric function to the data. The photometric parameters A (albedo), F (fraction covered by craters), gamma (crater angle) and H (compaction parameter) were determined for each site. The most meaningful parameter was H which varied by an order of magnitude over the disk. Geographically certain regions have low values of H (e.g., Oceanus Procellarum); others high (e.g., the southern uplands). There is only a weak correlation of H with albedo. The results suggest that the Hapke function should be modified to incorporate the effects of rocks on the surface. A conversion factor is provided to convert the data into photometric units; when such a conversion was made for the earth-based measurements of the Surveyor 1 site, excellent agreement was achieved with the in situ television camera measurements. Author

N70-11846*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RESPONSE OF ORBIT DETERMINATION SYSTEMS TO MODEL ERRORS

R. K. Squires, D. S. Woolston, and H. Wolf (Analyt. Mech. Assoc., Jericho, N.Y.) Nov. 1969 36 p

(NASA-TM-X-63742; X-[illegible]39-503) Avail: CFSTI CSCL 22C

The response of [illegible]uential and a Bayes minimum variance orbit determination s[illegible]rrors in the force model is discussed. The error is introduced i[illegible]e central mass but not solved. A half orbit of generated data at one minute intervals is used in all cases. They both arrive at the same orbit even after the so-called divergence of the sequential processor. The residual patterns obtained in the final orbit contain frequencies which appear like the sixth order zonal harmonic even though the error was due to the zeroth order term. It may be fallacious to analyze the frequency content of residuals. When this philosophy is applied in a manner similar to the mascon reduction technique, a residual pattern is obtained which bears a striking resemblance to the lunar orbiter residual patterns although no such mascons exist in the process. Hence, the technique of deriving mascons from a differentiation of residual patterns is suspect. Author

N70-11940# Warsaw Univ. (Poland). Astronomical Observatory.

CATALOGUE OF SUPERNOVAE DISCOVERED TILL THE END OF 1967

Maria Karpowicz and Konrad Rudnicki 1968 188 p refs *Its* Publ. Vol. 15

Avail: CFSTI

Well validated supernovae occurrences are listed in tables according to their variable and traditional designations, characteristics of the parent galaxy, coordinates in the parent galaxy or in intergalactic space, the month and year of maximum brightness, the year of discovery, the photographic magnitude, and the name of the discoverer. Suspected and false supernovae are listed in the same manner with general remarks on the actual nature of the object. A bibliography contains historical papers published before 1799, papers published later on individual supernovae, and unpublished communications and unelaborated material. Eight checklists contain data on supernovae in order to equatorial coordinates, NGC, IC and M numbers, Zwicky 1 and 2 designation systems, variable star designation, HD and Durchmusterung numbers, morphological types of supernovae, and names of discoverers. M.H.E.

N70-11974*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

SURVEY OF A SECOND CLASS OF ORBITS IN THE EARTH-MOON FIELD: X SUB R EQUALS 1.00

R. F. Hoelker Washington Nov. 1969 76 p refs

(NASA-TN-D-5529; C-86) Avail: CFSTI CSCL 22C

A class of orbits in the earth-moon field is discussed based on a sequence of illustrations. The class is defined by the common starting point of all orbits at the normalized coordinate X sub R = 1.00 on the rotating X sub R axis and by the orthogonality to this axis of the initial velocities of all its orbits. All motion is in a plane. The system model is that of the restricted problem of three bodies, with circular motion of the masses and the mass parameter mu = 1/80. Earth and moon are located on the X sub R-axis at −0.0125 and +0.9875, respectively. The objective of the study is, first, a graphical display of the class of orbits in steps small enough to allow interpolation and, secondly, through the exploit of appropriately composed survey graphs, the exposition of the class' main phase of development as well as their critical transitions. For comparison a suitably chosen class of Kepler orbits in rotating coordinates is carried in parallel. Author

N70-12020*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PULSARS AND X-RAY-EMITTING SUPERNOVA REMNANTS

Stephen S. Holt and Reuven Ramaty Nov. 1969 9 p refs

(NASA-TM-X-63741; X-611-69-495) Avail: CFSTI CSCL 04A

The possible existence of pulsars in known supernova remnants is investigated. Specifically, those remnants with observable X-ray luminosity were studied since, if such emission is nonthermal in origin, a contemporary source of high energy electrons is required to maintain the X-ray output. By analogy with the Crab Nebula, the energy required for the continual acceleration of those electrons may reside in a rotating neutron star. Author

N70-12043*# Texas Univ., Austin. Applied Mechanics Research Lab.

NUMERICAL OPTIMIZATION OF ATMOSPHERIC REENTRY TRAJECTORIES BY THE SWEEP METHOD

Cooper Odell Mc Gregor Jan. 1969 138 p refs Sponsored in part by LTV Aerospace Corp. of Dallas

(Contract NAS9-6963)

(NASA-CR-107033; TR-1002) Avail: CFSTI CSCL 22C

The successive sweep method developed recently to solve the two point boundary value problems appearing in nonlinear optimal control problems is modified and extended to handle inequality constraints explicitly containing the control. The method is modified to overcome the numerical difficulties near the singularities which usually appear on early iterates when attempting to optimize complex nonlinear systems. These modifications significantly increase the convergence range of the sweep method by allowing the iteration to continue when the singularities are encountered. The method is extended to include systems where inequality constraints are present. A procedure is developed to handle the inequality constraints by a method that exactly satisfied the constraints on each iterate. This is then compared to a penalty function method where violations of the constraint are allowed, but a penalty is associated with the violations. Author

N70-12101*# Columbia Univ., New York. Dept. of Astronomy.

MASS LOSS BY HOT STARS

L. B. Lucy and P. M. Solomon [1968] 43 p refs

(Grants NGR-33-008-012; NSF GP-9374)

(NASA-CR-106984) Avail: CFSTI CSCL 03B

A mechanism is proposed to explain the mass loss observed for luminous, hot stars. It is shown that the ultraviolet resonance lines of ions such as silicon IV carbon IV, nitrogen V, and sulfur VI can give strongly negative effective gravities in the outer parts of the reversing layers of hot stars. It is argued that a static reversing layer is then no longer possible and that a continuous outflow of mass occurs. To calculate mass loss rates resulting from this mechanism, formulation of the problem of steady-state, moving reversing layers is given. From numerical solutions of the equations of this problem, the mass-loss rate is found. The domain in the (logs of effective temperature and stellar surface gravity) plane where the greatest mass loss rates are expected is also approximately determined and found to be roughly consistent with observation. Finally, the problem of the supersonic flow to large distances from the star is briefly discussed. Author

N70-12126# Joint Publications Research Service, Washington, D.C.

UPPER ATMOSPHERE AND SPACE RESEARCH IN THE USSR IN 1968

Yu. I. Yefremov ed. 1 Aug. 1969 111 p refs Transl. into ENGLISH of the book "Issledovaniya Verkhney Atmosfery i Kosmicheskogo Prostranstva Vypolnennyye v 1968 Godu" Moscow, Izd. AN SSSR, 1969 99 p Presented at the 12th COSPAR Plenum, Prague

(JPRS-48528) Avail: CFSTI

CONTENTS:

1. LUNAR AND PLANETARY RESEARCH p 1-7 (See N70-12127 02-30)

2. STUDIES OF COSMIC RAYS, INTERPLANETARY MEDIUM AND MAGNETOSPHERE p 8-22 (See N70-12128 02-29)

3. STUDIES OF PHYSICS OF THE UPPER ATMOSPHERE AND METEOROLOGICAL RESEARCH p 23-37 (See N70-12129 02-20)

4. RESULTS OF OPTICAL OBSERVATIONS p 38-41 (See N70-12130 02-13)

5. BIOMEDICAL RESEARCH p 42-52 (See N70-12131 02-04)

6. OTHER RESEARCH p 53-58 (See N70-12132 02-07)

7. INTERNATIONAL COOPERATION p 59-63 (See N70-12133 02-31)

8. SPACE VEHICLE LAUNCHINGS IN THE USSR DURING 1968 p 64-66 (See N70-12134 02-31)

N70-12127# Joint Publications Research Service, Washington, D.C.

LUNAR AND PLANETARY RESEARCH

In its Upper Atmosphere and Space Res. in the USSR in 1968 1 Aug. 1969 p 1-7 (See N69-12126 02-30)

Avail: CFSTI

Space research data obtained by various space probes were correlated with ground observations and radioastronomical and astrophysical measurements of lunar and planetary properties. The correspondence between rocks in lunar seas and terrestrial basalts, together with the granular structure of the lunar ground, indicated a long historical development of the lunar surface under the influences of both endogenous and exogenous processes. A geological map of the moon was constructed and the distribution of rocks on the lunar surface established by random statistics. Geochemical comparison of the atmospheres of Venus and Earth from radioastronomical and radar measurements was used to compute a model of the Venusian atmosphere to an altitude of 100 - 200 km and to determine its energy transfer. Observed decreases in the continent-sea contrasts on Mars were correlated to low values of optical thickness of the Martian atmosphere and the great spectral variations of contrast due to aerosol particles. Jupiter studies of intensity changes in the absorption bands of ammonia and methane with transition from the center of the disk to the limb were attributed to multiple scattering and concentration changes of scattering aerosols of the planetary cloud layer. Photometric data from Saturn observations established the thickness of Saturn's ring in the range of 0.3 to 5 km. G.G.

N70-12187# European Space Vehicle Launcher Development Organization, Paris (France).

PROPAGATION OF INJECTION ERRORS ALONG A TRANSFER ORBIT [PROPAGATION DES ERREURS D'INJECTION SUR UNE ORBITE DE TRANSFERT]

E. Cambi Oct. 1969 36 p In FRENCH

(ELDO-TM-120) Avail: CFSTI

Explicit formulae for calculating errors in the state variables of an orbiting vehicle at the final point of a ballistic transfer are given, the errors existing at injection being already known. This is in order to evaluate the fuel consumption required for final adjustment. The reference system is centered on the nominal position of the vehicle and its orientation is determined by the nominal orbital plane. Emphasis is given to the orbital transfer case specifically relating to the 'perigee-apogee system' technique.

Author (ESRO)

N70-12191*# Princeton Univ. N. J. Plasma Physics Lab.

THEORETICAL IMPLICATIONS OF THE SECOND TIME DERIVATIVE OF THE PERIOD OF THE PULSAR NP0532

Attilio Ferrari and Remo Ruffini [1969] 17 p refs Sponsored jointly by ESRO and NASA

(Grant NSF GP-7669)

(NASA-CR-106994) Avail: CFSTI

The expected value of the second time derivative of the period of NP0532 is given and possible relations with existing magnetic dipole models are outlined. The amount of gravitational radiation to be expected is estimated. Author (ESRO)

N70-12260*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ATLAS OF COMETARY FORMS: STRUCTURES NEAR THE NUCLEUS

Juergen Rahe, Bertram Donn, and Karl Wurm Washington [1969] 135 p refs

(NASA-SP-198) Avail: SOD $2.25; CFSTI CSCL 03A

Photographic material on the structural features near the nucleus of comets is presented. Reproductions of drawings from visual telescopic observations of the comet central region made during the 19th and early 20th centuries are included. Both drawings and photographs which are presented for the Comets Halley and Daniel are analyzed. Several photographs of the bright comets Morehouse, Halley, and Humason are included to show the detailed structure near the nucleus. F.O.S.

N70-12388*# National Aeronautics and Space Administration, Washington, D. c.

TWENTIETH SEMIANNUAL REPORT TO CONGRESS, 1 JULY-31 DECEMBER 1968

Dec. 1968 247 p refs

(NASA-TM-X-62538; SAR-20) Avail: SOD $1.25; CFSTI CSCL 22A

This NASA report features the manned Apollo flights which tested the lunar module in earth orbit, next in lunar orbit, and then in landing on the moon. Also reported are launchings of scientific and applications satellites. The number of satellites launched included an Orbiting Astronomical Observatory, a radio astronomy Explorer, a Pioneer spacecraft placed in solar orbit, and a pair of Explorer satellites launched together. Two ESSA spacecraft laid the foundation for an operational weather satellite network. In aeronautics research, satisfying results were achieved in dissipating methods for warm fog. Studies of jet aircraft noise and on V/STOL aircraft moved ahead as various engine problems, aircraft configurations, and instrument displays were investigated. Evaluated was also a proposed supersonic transport design through wind tunnel tests and by using the XB-70 to collect related data. G.G.

N70-12440# Lockheed Missiles and Space Co., Palo Alto, Calif.

LUNAR VOYAGE OF THE ZOND-7

E. Kulabukhov 1969 3 p Transl. into ENGLISH from Aviats i Kosmonav. (USSR), no. 10, 1969 p 6-7

Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Mission accomplishments included photographing the earth and moon on the flight path, and measuring the physical characteristics of cosmic space, the moon, and the near-moon space. Experiments were conducted to check out: (1) the motion control systems, using computers to assure an optimal control law on all stages of the probe's flight; (2) the accuracy of astroorientation systems; (3) on-board long range radio communication apparatus for information reception and transmission from the probe, and for recording its motion parameters; and (4) radiation protection of the spacecraft and radiation dosage within the landing vehicles. M.H.E.

N70-12551*# California Univ., Berkeley. Space Sciences Lab.

LUNAR SURFACE ENGINEERING PROPERTIES EXPERIMENT DEFINITION Quarterly Report, 1 Oct.-31 Dec. 1968

James K. Mitchell, Richard E. Goodman, William N. Houston, and Paul A. Witherspoon 20 Feb. 1969 139 p refs *Its* Space Sci. Lab. Ser. 10, Issue 6

(Contract NAS8-21432)

(NASA-CR-102349; QR-2) Avail: CFSTI CSCL 03B

The developments in studying the mechanical properties of simulated lunar soils are reported. Activities described in detail include: (1) processing of the basic test soil; (2) performance of confined compression tests, triaxial shear tests, and trenching tests for cohesion determination; (3) study of soil placement techniques; (4) performance of boot imprint tests; and (5) reduction, analysis, and summarization of data. Author

N70-12556# Naval Observatory, Washington, D.C.
PUBLICATIONS OF THE UNITED STATES NAVAL OBSERVATORY, SECOND SERIES. VOLUME 19. PART 2. RESULTS OF OBSERVATIONS MADE WITH THE SIX-INCH TRANSIT CIRCLE, 1956–1962, OBSERVATIONS OF THE SUN, MOON, AND PLANETS CATALOG OF 2,554 STARS FOR 1950.0 CORRECTIONS TO FK4, GC, AND N30, 3419
A. N. Adams and D. K. Scott 1968 139 p
(AD-693646) Avail: CFSTI CSCL 3/1

The document contains the results of fundamental observations made with the six-inch transit circle between January 1956 and September 1962. The program included FK4 and FK4 Sup stars north of -30 declination, the sun, moon, major planets, and four minor planets. Author (TAB)

N70-12574*# California Univ., Berkeley. Space Sciences Lab.
MATERIAL STUDIES RELATED TO LUNAR SURFACE EXPLORATION, VOLUME 3 Final Report, 6 Mar. 1967 - 30 Jun. 1968
James K. Mitchell, Ian C. Carmichael, Joseph Frisch, Richard E. Goodman, Paul A. Witherspoon et al Mar. 1969 194 p
(Contract NSR-05-003-189)
(NASA-CR-102347) Avail: CFSTI CSCL 03B

The mechanical properties of the lunar surface materials are analyzed for use in the design of: spacecraft landing systems, surface mobility systems, and experiments to be conducted on the lunar surface. Subjects discussed include: (1) trafficability; (2) friction and adhesion in ultrahigh vacuum as related to lunar surface explorations; and (3) utilization of lunar soils for shielding against radiations, meteoroid bombardment, and temperature gradients. F.O.S.

N70-12688# United Kingdom Atomic Energy Authority, Culham (England). Translations Office.
OBSERVATION OF THE BRIGHTNESS DISTRIBUTION AT 1216 ANGSTROM AND 1300 ANGSTROM AT THE SOLAR LIMB
J. E. Blamont et al Apr. 1969 29 p refs Transl. into ENGLISH from CNRS report
(NP-Tr-1791; CTO-613) Avail: CFSTI

Two photometers were mounted on board a sounding rocket for the observation of the total solar eclipse in the Argentine on 12th November, 1966. Observations started at an altitude of 120 km on the ascending part and ended at an altitude of 123 km on the descending part of the trajectory. The brightness distribution at the limb of the solar disk and in the chromosphere up to 12,000 km at 1216 and 1300 A were determined with excellent relative accuracy. The geometric limb of the solar disk in this wavelength region is situated at an altitude of 2490 km in the chromosphere. An increase in brightness, or a bright ring, is observed at the limb of the disk with a total width of 18 seconds of arc at Lyman alpha and 6 seconds of arc at 1300 A. Author (NSA)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N70-11408*# Monsanto Research Corp., Dayton, Ohio.
PROCEDURE FOR ANALYSIS OF OFFGASSING CHARACTERISTICS OF NONMETALLIC SPACECRAFT MATERIALS, JULY 1968 - JULY 1969
J. V. Pustinger, Jr. and F. N. Hodgson Jul. 1969 223 p refs
(Contract NAS9-8340)
(NASA-CR-101995) Avail: CFSTI CSCL 22B

A procedure was devised to measure the thermal characteristics and the offgas products from nonmetallic spacecraft materials as tested through decomposition in atmospheres of nitrogen or oxygen at 5 psia. Indices describing thermal stability are obtained from differential scanning calorimetry (DSC), thermogravimetry (TGA), the first derivative of the weight loss curve (DTG), and a modified form of mass psectrometric thermal analysis (MTA). Characterizations of the offgas products from ten representative spacecraft materials were made by a tandem coupled gas chromatographic mass spectrometric system. Activation energies for individual components are reported to show the relative stability of different portions of the nonmetallic materials. Author

N70-11428# Atmospheric Sciences Lab., White Sands Missile Range, N.M.
A RAPIDLY CONVERGING ITERATIVE TECHNIQUE FOR COMPUTING WIND COMPENSATION LAUNCHER SETTINGS FOR UNGUIDED ROCKETS
Louis D. Duncan and Bernard F. Engebos Jul. 1969 31 p refs
(AD-693253; ECOM-5259) Avail: CFSTI CSCL 4/2

The paper presents the development and evaluation of two algorithms for the determination of wind compensating launcher settings for unguided rockets. The algorithms are designed for use in an iterative trajectory simulation process and can be used to determine launch angles which will yield one of many possible trajectory objectives. One algorithm provides the first estimate as a function of the ballistic wind; the other controls the iteration. Four test cases are presented to evaluate the technique. Sixteen different wind profiles were applied to four separate unguided rockets. Two different trajectory objectives were considered - nominal burnout attitude and nominal impact. The tests show that the process converges rapidly, usually requiring only one or two iterations. Author (TAB)

N70-11440# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
TEST AND EVALUATION OF A FLUIDIC THRUSTER FOR ROLL CONTROL OF AIR BREATHING MISSILES
T. M. Rankin May 1969 89 p refs
(Contract NOw-62-0604C)
(AD-693050; TG-1051) Avail: CFSTI CSCL 13/7

A fluidic thruster designed for roll control of an air-breathing missile has been tested and evaluated. Since, for this particular application, the thruster receives its supply air from the engine air inlet duct, the thruster evaluation consisted of determining how efficiently the thruster diverts the high-energy air and exhausts it supersonically into the ambient atmosphere to generate the required roll control reaction forces. It is concluded that an array of four appropriately sized thrusters equally spaced about the diameter of a missile will develop adequate roll control torque for typical air-breathing missiles using a total of 1% of the engine air. Author (TAB)

N70-11520# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
SOME COMPUTATIONAL ASPECTS OF THE MINIMUM FUEL CONTINUOUS LOW THRUST ORBIT TRANSFER PROBLEM Research Report, May - Mar. 1969
J. L. Starr and R. D. Sugar 4 Aug. 1969 58 refs
(Contracts F04701-68-C-0200; F04701-69-C-0066)
(AD-693563; TR-0066(5306)-3; SAMSO-TR-69-283) Avail: CFSTI CSCL 22/3

The purpose of this paper is to examine the computational

aspects of the minimum fuel continuous low thrust orbit transfer problem and to display characteristic numerical features introduced by various physical constraints. Minimum-fuel orbit transfer by low thrust is typical of many problems in optimal control which result in a two point boundary value problem which must be solved by some iterative numerical procedure. Two techniques, Multiple Substitution Polynomials (MSP) and Marquardt's method, are shown to be applicable to this task, and a detailed analysis is made of the behavior of these methods in the context of the low thrust problem. A variety of sub-problems is considered with parametric variation of endpoints, thrust-to-weight ratio, and orbit axial orientation. A physical barrier is found which restricts sample points in certain limiting case fixed endpoint transfers. The existence of multiple stationary solutions is shown for the case of intersecting orbits, and the nearly singular behavior in that region is investigated. Numerical results for several transfers are found to compare with similar results reported elsewhere. Author (TAB)

N70-11810# Aerospace Corp., El Segundo, Calif. Cornell Aeronautical Lab., Inc., Buffalo, N.Y. Materials Science Lab.
DESIGN AND TESTING OF ABLATION MODELS WITH CONTROLLED PRESSURE GRADIENTS Research Report, Sep. 1967–Jun. 1968
W. T. Barry and E. B. Fisher 28 Feb. 1969 33 p refs Prepared in cooperation with Cornell Aeronautical Lab.
(Contract F04701-68-C-0200)
(AD-693559; TR-0200(4250-40)-7; SAMSO-TR-69-187) Avail: CFSTI CSCL 16/3

Studies of high-pressure ablation mechanisms have been hampered by lack of suitable ablation models. A technique has been developed to contour wedge models for testing in the wave superheater to give either a constant pressure, a constant heat transfer, or a constant pressure gradient up to the limit of the facility. Preliminary testing with a standard carbon phenolic composite shows that high recession rates occur even in the absence of a significant pressure gradient. Author (TAB)

N70-11798# National Research Council of Canada, Ottawa (Ontario). Space Research Facilities Branch.
BLACK BRANT ROCKET ABD-VB-23 LAUNCHED AT CHURCHILL RESEARCH RANGE 31 MARCH 1969
Sep. 1969 28 p refs
(SRFB-031; PD-8789) Avail: CFSTI

The engineering aspects of preparing the payload and the launching of Black Brant rocket and experimental results are described. The payload was designed to measure auroral emissions during a Type A aurora, to obtain luminosity profiles at 2972 A, and to measure the flux and spectrum of incoming low energy protons and electrons. A scanning photometer was operated at 5577 A and 6300 A, and the vertical luminosity profile of visible emissions was also determined. Electron density, temperature and structure, and micrometeoroid impacts were also measured. Both the vehicle and experiments performed as scheduled and good data were obtained. Author

N70-11884# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNDAMENTALS OF MISSILE GUIDANCE
Ya. Kh. Vermishev 9 Jun. 1969 342 p refs Transl. into ENGLISH from the Russian
(AD-693004; TD-HT-23-1313-68) Avail: CFSTI CSCL 16/4

This book is intended for students of military academies and institutes of higher education, as well as for engineering and technical personnel concerned with the immediate problems of the operation and testing of control systems, or with related problems. The various sections of the book, which are a comprehensive description of the physical processes, may be recommended for readers with intermediate technical education. The principles of building guidance systems, as well as the mathematical bases for calculating these systems, are examined on the basis of materials published in the domestic and foreign literature. There is a discussion of modern engineering methods of calculating complex systems of automatic regulation, and the basic methods and physical nature of the linearization of nonlinear systems are outlined. The physical principles of guiding rockets of various aerodynamic configurations, as well as the basic mathematical relationships describing the motion of rockets, are presented. Author (TAB)

N70-11904# National Research Council of Canada, Ottawa (Ontario). Space Research Facilities Branch.
BOOSTED ARCAS 2 ROCKETS AMM-BA-01, 02, AND 03 LAUNCHED AT CHURCHILL RESEARCH RANGE 18 APRIL 1969
Nov. 1969 20 p
(SRFB-032; PD-8787) Avail: CFSTI CSCL 22B

The engineering aspects of preparing the payloads and the launching of three boosted ARCAS 2 rockets carrying similar experiments at Churchill Research Range on 18 April, 1969 are reported. Payloads included two channel photometers with filters at 1.27 microns, 7300 A and 7620 A and atomic oxygen detectors. Rockets were launched under quiet geophysical conditions at solar zenith distances of approximately 75 deg, 95 deg, and 110 deg. Data were obtained from the first two flights. Author

N70-11943*# Auburn Univ., Ala. School of Engineering.
STARLAB: AN ORBITING SPACE TECHNOLOGY APPLICATIONS AND RESEARCH LABORATORY Final Report
Sep. 1969 376 p ref
(Grant NSR-01-003-025)
(NASA-CR-106971) Avail: CFSTI CSCL 22B

STARLAB is a 35-man orbiting Space Technology Applications and Research Laboratory preliminary design and a training exercise in the systems approach. The selected orbit is 308 n.mi. with a 69-degree inclination which enables coverage of 93 percent of the earth's surface. The onboard experiments utilize research and application laboratories with auxiliary supporting laboratories. A laser communication system with a 3000 megabits per second data rate, three synchronous communication satellites, and an earth-based administration function comprises the information management system. Emphasis is given to earth resources, chemistry, life/behavioral sciences, physics, materials and manufacturing, communication, navigation and traffic control, manned space flight engineering, and astronomy. The design is based on the existence of the shuttle with a 50,000-pound payload capability. Free-flying modules for selected experiments augment the 430-foot-long nuclear-powered STARLAB. Existing Saturn 5 capabilities are used for launch. Author

N70-11998*# Bolt, Beranek, and Newman, Inc., Van Nuys, Calif.
DEVELOPMENT OF IMPROVED VIBRATION TESTS OF SPACECRAFT ASSEMBLIES
Oct. 1968 45 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951990)
(NASA-CR-106985; JPL-1702) Avail: CFSTI CSCL 22B

The results of an experimental research program to develop a novel type of spacecraft assembly-level vibration test are reported. A multimodal test fixture which is designed to simulate the high-frequency (100 to 2000 Hz) dynamic characteristics of a Mariner spacecraft structure is developed. The data obtained in research vibration tests of a simulated Mariner electronic assembly mounted in the multimodal fixture indicate that the novel testing technique results in a more realistic and more uniform high-frequency vibration environment on the assembly than conventional assembly-level tests utilizing rigid fixtures. The report presents guidelines for designing and utilizing multimodal type fixtures in future spacecraft assembly-level vibration test programs. Author

N70-12133# Joint Publications Research Service, Washington, D.C.
INTERNATIONAL COOPERATION
In its Upper Atmosphere and Space Res. in the USSR in 1968 1 Aug. 1969 p 59 - 63 (See N69-12126 02-30)
Avail: CFSTI

International cooperation in the study and use of space is outlined through participation in a number of projects. Implementation of major rocket and satellite programs includes investigations of space physics with emphasis on structure and dynamics of the earth's upper atmosphere and ionosphere, investigations of solar short-wave radiation and solar activity and the study of cosmic rays and radiation belt particles in the earth's magnetosphere as well as of solid components in interplanetary matter. Increased work is also reported on the problem of ensuring life-support conditions for man during long-term space flight. G.G.

N70-12134# Joint Publications Research Service, Washington, D.C.
SPACE VEHICLE LAUNCHINGS IN THE USSR DURING 1968
In its Upper Atmosphere and Space Res. in the USSR in 1968 1 Aug. 1969 p 64-66 (See N69-12126 02-30)
Avail: CFSTI

Tables are presented that contain pertinent data for space vehicle launchings in the U.S.S.R. during 1968. Data depict launch date, apogee and perigee, inclination of orbit, period of revolution, months, etc. The various vehicles are identified by numbers and names. G.G.

N70-12323*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THRUST VECTOR CONTROL REQUIREMENTS FOR LAUNCH VEHICLES USING A 260-INCH SOLID ROCKET FIRST STATE
Carl J. Daniele, Leslie L. Scalzott, and Janos Borsody Washington Dec. 1969 58 p refs
(NASA-TM-X-1906) Avail: CFSTI CSCL 22B

Gimbaled nozzle and liquid injection thrust vector control requirements are derived for a family of 260-in. (6.61-m) solid rocket launch vehicles with two different second stages. The use of biased pitch programs is assumed. Also, the use of fins in reducing requirements is investigated. It is shown that the use of fins is not warranted for the gimbaled nozzle system unless the deflection angle for winds is much greater than that required for pitchover. Also, the use of fins does not reduce liquid injection system requirements significantly. Author

N70-12394# European Space Research and Technology Center, Noordwijk (Netherlands).
ON BEHAVIOUR IN ORBIT OF THE ESRO SATELLITE 'AURORAE' Interim Report
D. E. Mullinger, J. Plevin, R. Kammüller, C. C. Kalweit, F. v. Ingen et al Mar. 1969 86 p refs
(ESRO-TN-92-ESTEC) Avail: CFSTI

The polar ionospheric spacecraft ESRO I 'Aurorae' was launched by a NASA Scout vehicle from the Western Test Range, on 3 October 1968. The designation for the spacecraft is 1968-084A. The principal orbital elements achieved were apogee 1533 km, perigee 258 km and inclination 93.8 deg. The spacecraft operates on two transmitter frequencies of 136.170 and 136.950 MHz with a command receiver frequency of 148.250 MHz. This note describes the ESRO I spacecraft and gives details of the scientific mission and the choice of orbit. The behaviour of the spacecraft and of all sub-systems during the first six weeks of operation is reported in some detail. The launch sequence is described and notes are given of the ground operations such as tracking, data acquisition and spacecraft control. Author (ESRO)

N70-12549*# Avco Corp., Lowell, Mass. Applied Technology Div.
CONTINUATION OF THE DEVELOPMENT OF A TYPICAL MARS LANDING CAPSULE STERILIZATION CONTAINER Final Report
16 May 1969 152 p
(Contract NAS8-20682)
(NASA-CR-102339; AVATD-0081-69-RR) Avail: CFSTI CSCL 22B

Technical details are presented of the efforts to establish procedures for certifying that operational capsule systems undergo minimum recontamination with microorganisms during the deployment mode, space cruise maneuvers, and other phases which threaten sterility. In survival studies, preparatory experiments were performed to choose a tracer organism, select a carrier material, and determine optimal initial concentration of the test organism. The mechanisms which transport microorganisms from probable contaminated sites to recontaminate a sterile lander capsule were analyzed. Vibration tests to determine ease of organism release from surface and experiments to measure electrical properties of dried spores were performed. The witness techniques for testing the recontamination-inducing qualities of sterilization canisters are described. A probabilistic recontamination model was developed and the framework for a ground test certification plan is summarized. Areas for additional study are identified as an evaluation of recontamination probability factors, flight tests, ultracentrifuge method for testing organism release, and ultraviolet exposure experiments. N.E.N.

N70-12597*# General Dynamics/Fort Worth, Tex.
ANALYTICAL AND EXPERIMENTAL DEVELOPMENT PROGRAM FOR INFLATABLE SOLAR SHIELDS Quarterly Progress Report, 1 Jan. - 31 Mar. 1969
15 Apr. 1969 26 p
(Contract NAS8-21132)
(NASA-CR-102352; FPR-056-5; QPR-7) Avail: CFSTI CSCL 22B

The main tasks performed in this reporting period included completion of qualification testing of test fixture drive system and instrumentation, fabrication of the 15-ft-dia solar shield model, conduct of a third test of the 1/4-scale model in the space simulation facility, evaluation of improper foam impregnation for the third 1/4-scale test, and continuation of work on the draft of the contract technical summary report. Author

N70-12610*# California Univ., Los Angeles. Dept. of Engineering.
AN INVESTIGATION STUDY ON MODEL REFERENCE ADAPTIVE TECHNIQUES AS APPLIED TO ATTITUDE CONTROL SYSTEM FOR LAUNCH VEHICLES Final Report
C. T. Leondes, E. B. Stear, and A. R. Stubberud Apr. 1969 176 p refs
(Contract NAS8-21019)
(NASA-CR-102346) Avail: CFSTI CSCL 22B

An attitude control system with sufficient stability margins so that moderate changes in design do not require redesign of the system is considered. The feasibility of defining future areas of research for the development of a prototype model reference adaptive control system, applicable to the Saturn 5 launch vehicle is studied. A survey of model reference adaptive control is presented, and the application of a self adaptive technique to the suppression of the flexible response in vehicles is examined. It is concluded that under certain flight conditions, adaptation reduces the stability margins for flexible modes, and causes the flexible modes to become unstable. Recommendations for alternate approaches are included. F.O.S.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N70-11434# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
DISTORTION OF A FINITE AMPLITUDE STANDING WAVE IN AN ELASTIC PANEL
M. P. Mortell and E. Varley Aug. 1969 53 p refs
(Contract DAAD05-69-C-0053)
(AD-693284; CAM-110-6) Avail: CFSTI CSCL 20/11

The equations governing the stretching of a nonlinear elastic panel of finite length are integrated in the limit when the strains are small but the strain rates are comparable with the natural frequency of the panel. It is shown that such a theory must be used when investigating the distortion and decay of a disturbance which is produced by impact and reflection. The mathematical problem involves functions whose values repeat at a sequence of times which are separated by a time interval which depends on the current value of the function. TAB

N70-11439# Naval Civil Engineering Lab., Port Hueneme, Calif.
NCEL OCEAN ENGINEERING PROGRAM, MARCH 1968 – MARCH 1969
Aug. 1969 59 p refs
(AD-693192) Avail: CFSTI CSCL 13/10

Contents: Manpower; Diver construction and salvage; Sea-floor soils; Undersea site and material studies; Undersea equipment and installations; Ocean structures; Deep submergence simulation facility. TAB

N70-11484*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SIMPLIFIED BALLISTIC-LIMIT EXPRESSIONS FOR THIN SHEETS
Doene J. Weidman Washington Nov. 1969 15 p refs
(NASA-TN-D-5556) Avail: CFSTI CSCL 20K

Perforation of the plates was assumed to be caused by a shearing failure of the plate material due to impact by a rigid circular cylindrical projectile. Simplified equations for predicting the ballistic-limit velocity of the projectiles were also presented. The plate was assumed to behave as a viscoplastic solid. The equations were based on a simplification of a more accurate and complete solution dealing with perforation of a viscoplastic solid. Numerical results were compared with both experimental results and calculations based on the more accurate analysis. These comparisons indicate that the equations are valid for short cylindrical projectiles. Author

N70-11510# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.
FIELD EQUATIONS GOVERNING THE MECHANICAL BEHAVIOR OF LAYERED CYLINDERS
Fang Hui Chou, Jan Drewes Achenbach Aug. 1969 34 p refs
(Contract Nonr-1228(34)
(AD-693626; TR-69-3) Avail: CFSTI CSCL 11/4

A system of governing equations is derived to describe the mechanical behavior of multilayered cylinders, which consist of alternating layers of a high modulus reinforcing material and a low modulus matrix material. According to the theory proposed herein, the state of deformation in the multilayered body can be described by fields defining gross displacements and local deformations. The system of governing equations includes stress equations of motion, constitutive relations, boundary conditions and displacement equations of motion. Author (TAB)

N70-11524# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF THE FATIGUE LIMIT IN THE CASE OF AN ASYMMETRICAL STRESS CYCLE
P. I. Nezhentsev 5 Jun. 1969 13 p Transl. into ENGLISH from Nikolayev. Shipbuilding and Marine Installations (Russian), no. 2, 1966 p 143–149
(AD-692638; FTD-HT-23-117-68) Avail: CFSTI CSCL 20/12

The paper discusses the complications involved in predicting fatigue life on the basis of tests or observations to establish S-N relationships. The various formulas proposed in the literature for calculating the fatigue limit under symmetric and asymmetric cyclic loading are reviewed and compared with experimental data. A convenient method is proposed for constructing a simplified maximum stress diagram and a general expression is given for the fatigue limit. A comparison between experimental data and the results given by this formula shows a divergence of 1.5-6 percent. In using these formulas, it is sufficient to know the tensile strength of the material and the fatigue limit in the case of a symmetric stress cycle, i. e. figures which may be found in the reference literature. TAB

N70-11536# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
PHOTOELASTICITY WITH FINITE DEFORMATIONS
G. F. Smith and R. S. Rivlin Jul. 1969 35 p refs
(Contract-DAAD05-69-C-0053)
(AD-693267; CAM-110-5) Avail: CFSTI CSCL 20/11

A phenomenological theory is developed for the propagation of plane electromagnetic waves in a deformed non-absorbing centrosymmetric isotropic material. It is assumed that the dielectric constant and specific reluctance matrices depend on the deformation gradients at the instant of measurement. The theory is formulated from both the Eulerian and Lagrangian standpoints. Author (TAB)

N70-11540# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PROBLEM OF FAILURE OF A BRITTLE BODY WITH A DISK-SHAPED CRACK
V. V. Panasyuk et al 11 Jul. 1969 8 p refs Transl. into ENGLISH from Prikl. Mekhan., v. 3, no. 12, 1967 p 28–33
(AD-693494; FTD-HT-23-500-68) Avail: CFSTI CSCL 20/11

The limit equilibrium of an infinite homogeneous isotropic solid with an internal lentil-shaped crack of diameter 2a is discussed. Monotonically increasing, mutually orthogonal, uniformly distributed stresses (tension or compression) p and q are applied at infinity parallel to the xOz plane at angle to the xOy plane; there are no external forces on the crack surface. The problem is to determine the limit values p and q at which the crack starts to propagate, i.e., when a local failure occurs in the solid. The following premises are made. The state of stress in the neighborhood of the cracks contour is considered as a sum of two states: (a) stresses in a three-dimensional elastic solid without a crack subjected to stresses p and q applied at infinity; and (b) stresses in this solid with a lentil-shaped crack. The broken line bounds the domain of values for p and q, which do not endanger the strength of a brittle solid with cracks of the type discussed. Author (TAB)

N70-11595# Massachusetts Inst. of Tech., Cambridge. Dept of Mechanical Engineering.
RANDOM VIBRATION STUDIES Final Scientific Report, 1 Nov. 1963 – 30 Oct. 1968
Dean C. Karnopp 1 Jul. 1969 10 p refs
(Contract AF 49(638)-1314)
(AD-693621; AFOSR-69-1906TH) Avail: CFSTI CSCL 20/11

During the contract period, research was concentrated in the following four areas: nonlinear and, particularly, hysteretic system response to stochastic inputs; fatigue and first passage failure prediction; analysis of coupled structures; and the application of automatic control principles to the reduction of structural vibration. Author (TAB)

N70-11599# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POST-CRITICAL DEFORMATIONS OF A SHORT CYLINDRICAL SHELL AND A SQUARE PANEL UNDER

AXIAL COMPRESSION
V. V. Mykhaylov 14 Jul. 1969 5 p ref Transl. into ENGLISH from Dopi Vodi Akad. NAUK Uk. RSR, Ser. Fiz.-Tekn. Ta Matematichni Nauki (Kiev), v. 29, no. 4, 1967 p 350–353
(AD-693477; FTD-HT-23-868-68) Avail: CFSTI CSCL 20/11

The buckling and postbuckling deformation of a cylindrical panel between stringers and lateral frames of a circular cylindrical shell under axial compression as well as of the shell itself is investigated by using the A. V. Pogorelov method. TAB

N70-11668# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
PROPAGATION OF HARMONIC WAVES IN COMPOSITE CIRCULAR CYLINDRICAL RODS
Anthony E. Armenakas Feb. 1969 85 p refs
(Contract Nonr-839(40))
(AD-693038; Pibal-69-4) Avail: CFSTI CSCL 20/11

Recent interest in the dynamic behavior of sandwich shells used as components in submarines, aircraft, missiles and, particularly, in solid propellant rocket motors has instigated a number of investigations on the propagation of trains of harmonic waves in rods or shells composed of a circular core of an elastic isotropic material bounded by and bonded to a circular casing of another elastic isotropic material. In this investigation the general frequency equation for harmonic waves having an arbitrary number of circumferential nodes, traveling in composite, traction-free, circular, cylindrical rods is established on the basis of the linear three-dimensional theory of elasticity. Simpler degenerate cases of the frequency equation are reduced and discussed. A numerical evaluation of the frequency equation is presented. The results are obtained by programming an iteration procedure on an IBM 7094 digital computer. The effect of the variation of the physical and geometric parameters of the rod on the frequencies and mode shapes of the first few modes is illustrated and discussed. Moreover, the feasibility of utilizing composite rods as delay media in guided wave ultrasonic delay lines is considered briefly. Author (TAB)

N70-11670# Dayton Univ., Ohio.
HYPERVELOCITY PERFORATION MECHANICS OF THIN METAL PLATES
William C. Turpin, Hallock F. Swift, Lewis A. Shiverdecker, Henry R. Taylor, and Edward A. Strader Jul. 1969 202 p refs
(Contract F33615-68-C-1138)
(AD-693572; AFML-TR-69-203) Avail: CFSTI CSCL 11/6

An experimental investigation was conducted to examine hypervelocity perforation mechanics of thin aluminum and copper plates impacted at 5 to 7 km/sec by 3.18 mm spheres of like material. Flash radiography showed hole growth to be a two stage process with no rebound of the hole periphery. Dissection techniques were developed to measure debris origin and velocity. High energy debris was found to depart the plates during the first stage of hole growth. Foil strain gages on the plates recorded less than 0.2 percent strain at 4.5 projectile diameters from impact. All results were compared with a representative 2D hypervelocity impact computer code. Author (TAB)

N70-11699# Brown Univ., Providence, R.I. Div. of Engineering.
CONVERGENCE APPROXIMATIONS FOR DYNAMICALLY LOADED RIGID-PLASTIC STRUCTURES
John B. Martin and J. Declan O'Keeffe Jun. 1969 141 p refs
(Contract N00189-68-C-0157)
(AD-693542; BU/NSRDC/13) Avail: CFSTI CSCL 13/13

The term convergency approximation is applied to a group of techniques for the approximate analysis of rigid-plastic structures subjected to dynamic loading. These techniques are based on the sufficient conditions for uniqueness for such structures, and make use of the converging nature (in an appropriately defined sense) of two solutions with different initial conditions but the same boundary conditions. The important feature of the technique is that it provides a means whereby, again in an appropriately defined manner, an estimate of the error involved in the approximate solution can be estimated. The present report is a unified description of the applications of the technique. Earlier work on impulsively loaded structures is reviewed, for both rigid-plastic and rigid-visco-plastic structures, and illustrated by examples. New work on applications of the method for pulse loaded structures is included. Author (TAB)

N70-11789# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE GENERALIZED EQUATION OF METAL FAILURE UNDER CONDITIONS OF THERMAL FATIGUE
G. S. Pisarenko et al 10 Jul. 1969 7 p refs Transl. into ENGLISH from Dopivida Akad. Nauk Ukr., Ser. Fiz-Tekhn Matematichni Nauki (Kiev), v. 29, no. 9, 1969 p 838–842
(AD-693479; FTD-HT-23-1190-68) Avail: CFSTI CSCL 20/11

The basic laws of the thermal fatigue process are considered. From these it is possible to est. quant. the effect of the temp. and of the mech. properties of the material on the conditions of the failure during metal fatigue. Author (TAB)

N70-11795# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY OF ORTHOTROPIC VISCOELASTIC SHELLS
P. M. Ogibalov et al 30 Jun. 1969 8 p refs Transl. into ENGLISH from Prikl. Mekh., Akad. Nauk Ukr. RSR (Kiev), v. 3, no. 8, 1967 p 1–10
(AD-693509; FTD-HT-23-609-68) Avail: CFSTI CSCL 20/11

The authors review the basic principles of the closed quasilinear quadratic theory of viscoelasticity of physically nonlinear media as proposed by A. A. Ilyushin and P. M. Ogibalov. A system of nonlinear equations of bending and stability is proposed for flexible (i.e. with regard to geometric nonlinearity) shallow plates and shells made from orthotropic materials with linear properties (fiberglass-reinforced plastics). It is assumed that the hypothesis of straight normals is applicable to these plates and shells. It is also assumed that stresses normal to the middle surface are insignificantly small compared to the other components and that the shells and plates remain orthotropic throughout the entire deformation process. A method of solving the proposed equations is outlined and illustrated by analysis of the stability of a rectangular orthotropic plate of slightly curved panel of fiberglass-reinforced plastic with given stress relaxation curves. The results agree satisfactorily with experimental data on creep in a square plate hinged at the edges. Methods are also given for determining the upper and lower critical loads as related to the loading conditions and the critical time. A viscoelastic solution is found by the proposed method for the problem of stability of a compressed cylindrical shell and compared with an elastic solution found by the Ritz method. Author (TAB)

N70-11800# ITT Research Inst., Chicago, Ill. Engineering Mechanics Div.
MANUAL FOR THE RESPONSE OF STRUCTURAL MEMBERS, VOLUME 1 Final Report, 1 May 1968–1 Sep 1969
Walter D. Pilkey Aug. 1969 342 p
(Contract N00014-66-C-0343)
(AD-693141; IITRI-J6094-Vol-1) Avail: CFSTI CSCL 13/13

This is a manual of solutions for the static, stability, and dynamic response of a large class of structural members and mechanical elements with arbitrary geometry and loading. The line-solution (transfer matrix, initial parameter) method is used throughout the manual to systematically provide solutions which are suitable for computational implementation. The manual contains a documented computer code, including an optional time-sharing version, designed for use in conjunction with the manual to obtain solutions to all of the problem types considered. The structural members and mechanical elements treated include strings, bars,

spring mass systems, beams, thin-walled beams, arches, membranes, plates, gridworks, thick shells, thin shells, and simple frames. They are represented by classical theories of linear elasticity and strength of materials. The materials may be elastic or viscoelastic, the geometries are basically those of classical structural members with arbitrary cross section, and the thermal and mechanical loadings may be given deterministic or statistical characterization.
Author (TAB)

N70-11801# ITT Research Inst., Chicago, Ill. Engineering Mechanics Div.
MANUAL FOR THE RESPONSE OF STRUCTURAL MEMBERS, VOLUME 2
Walter D. Pilkey Aug. 1969 577 p
(Contract N00014-66-C-0343)
(AD-693143; IITRI-J-6094-Vol-2) Avail: CFSTI CSCL 13/13
For abstract see N70-11800.

N70-11822*# Arizona State Univ., Tempe. School of Engineering.
A GREEN'S FUNCTION APPROACH TO THE NATURAL VIBRATION OF THIN SPHERICAL SHELL SEGMENTS: A NUMERICAL METHOD Final Report
James P. Avery and Michael T. Wilkinson [1968] 64 p refs
(Grant NGR-03-001-013)
(NASA-CR-106999) Avail: CFSTI CSCL 20K

A development of Green's function approach to the analysis of linear, undampened vibration of thin spherical shell segments is presented. The segments are of arbitrary contour, simply or multiply connected, and have mixed arbitrary boundary conditions specified along the bounding contour. As a demonstration, the developed method is applied to the shallow shell symmetric vibration problem and results are compared with a published solution. Author

N70-11847# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMODYNAMIC ANALYSIS OF EQUATIONS OF LINEAR ELASTIC-VISCOUS ANISOTROPIC BODY
V. P. Tatuzh and Yu. D. Yanson 31 Jan. 1969 18 p refs Transl. into ENGLISH from Mekh. Polimerov, Akad. Nauk Latv. SSR (Riga), no. 2, 1967 p 227–235
(AD-693476; FTD-HT-23-773-68) Avail: CFSTI CSCL 20/12

A vectorial equation of state was deduced for a linear viscoelastic continuum under applied stress in n-coordinate space. If a math condition is satisfied (expressed by an ordered inequality of two of two scaler derivs of two vectors), then potential energy and rate of energy dissipation at any point away from the origin (where, by definition, entropy = 0) can be obtained. The condition is sufficient to prevent occurrence of any sinusoidal deformation under constant stress. Author (TAB)

N70-11950*# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
ANALYSIS OF PLATE STRUCTURES BY A DUAL FINITE ELEMENT METHOD
Peter Kei-Kin Ho Sep. 1969 197 p refs
(Grant NGR-22-009-059)
(NASA-CR-106969; R69-58) Avail: CFSTI CSCL 20K

A dual finite element method is developed for the analysis of the stretching and bending of linearly elastic, orthotropic plates. This finite element method is based on the duality that exists between the problems of plate stretching and bending. Nodal displacements are the unknowns in the stretching problem while nodal stress functions are those in the bending problem. A variational principle is used in formulating the governing system of equations. The boundary conditions considered are those of stress, displacement, mixed, elastic, edge beam, and strain in stretching; and those of displacement, stress, mixed, and stress function in bending. The finite element method is implemented into a computer system named the PLANAL System, representing the Plate Analysis Language. The PLANAL System is developed as a subsystem of the Integrated Civil Engineering System (ICES). A user's manual and examples of application of PLANAL are included. Results from the examples are in close agreement with theoretical values.
Author

N70-11952*# Watervliet Arsenal, N.Y. Benet R and E Labs.
EXPERIMENTAL AND ANALYTICAL STRAINS IN AN EDGE-CRACKED SHEET
John H. Underwood, J. L. Swedlow (Carnegie-Mellon Univ.), and David P. Kendall Sep. 1969 38 p refs
(Grant NGR-39-002-023; DA Proj. 1-T-0-61102-B32A)
(NASA-CR-106904; WVT-6933) Avail: CFSTI CSCL 20K

The nature and some details of the elasto-plastic strain distribution ahead of the crack tip in an edge-cracked sheet has been determined by experiment and analysis. The experiment uses the optical interference and moire techniques. The analysis is a generalized plane stress model using the finite element method; the measured uniaxial stress-strain properties of the materials are used as input to the analysis. Materials investigated by one or both methods are 1018 steel, copper, 90-10 and 70-30 brass, and 6061-T6 aluminum. Of these materials, meaningful comparisons between experiment and analysis have been made for those with no discontinuity in uniaxial behavior, copper, 90-10 brass, and aluminum. The agreement between experiment and analysis can be significantly affected by how well the early, uniaxial, yield properties used in the analysis represent the actual properties of the experimental specimens. Author

N70-11955# Michigan Univ., Ann Arbor. Lab. of Cavitation and Multiphase Flow.
EFFECTS OF EXTERNAL LOAD ON CAVITATION DAMAGE
Dale J. Kemppainen and Frederick G. Hammitt Mar. 1969 32 p Presented from IAHR Symp., Kyoto, Sep. 1969
(KAPL-P-3813; CONF-680902-1) Avail: CFSTI

Cavitation damage rates in an ultrasonic cavitation field upon specimens subjected to an externally applied stress are reported. Brass, bronze, aluminum, magnesium, copper, stainless steel, and carbon steel were tested in cold water under tensile and compressive stresses of 3/4 of their yield strength, and in one case at twice that value. Damage rates under stress were compared with those for identical specimens under zero load. Generally it was found that compression tends to reduce damage during the constant damage rate portion of the test, while tension increases it. The magnitude, and in some cases the direction of the trend, differed for different materials. Measurements were made on the effects of a given cavitation volume loss upon the yield and tensile strength of the specimens. The effect is much greater than that which would be predicted on the basis of an exactly uniform damage distribution (mean depth of penetration) across the specimen.
Author (NSA)

N70-11986# California Univ., Livermore. Lawrence Radiation Lab.
STATISTICAL NATURE OF FRACTURE
Ernest Y. Robinson 30 Mar. 1969 37 p refs
(UCRL-50622) Avail: CFSTI

Methods for statistical analysis of strength and fracture of materials are examined. The weakest link model is considered in a fairly general form, and the resulting equations are demonstrated by using a Weibull distribution for flaws. Working charts are included to facilitate interpretation of observed data. Nominally ductile materials often show extreme variability in fracture toughness measurements. Estimates of the operational capability of a part made from such a material must account for the variation of flaw intensities (a statistical variable dependent on geometry and fabrication), the variation of fracture toughness (a statistical variable dependent on material properties), and the quantity and density of

flaws in the part. Examples are cited which indicate that the most intense flaw is likely to be found in association with the weakest material in terms of fracture toughness, thus corroborating the need for a statistical approach to failure prediction. Idealized failure in a system comprising parallel brittle elements is described. Author (NSA)

N70-12205*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMOELASTIC INSTABILITY OF OPEN-SECTION BOOMS
James H. Donohue and Harold P. Frisch Washington Dec. 1969 17 p refs
(NASA-TN-D-5310) Avail: CFSTI CSCL 20K

When the sun shines on a hollow cylindrical boom in space, a temperature gradient develops across the boom. The resulting differential thermal expansion generates a thermal bending-moment distribution along the boom, causing it to bend away from the sun. If the thermally bent boom, is deflected in the out-of-plane direction, twist is produced along the boom. If it is of sufficient magnitude and properly phased, then the boom can be thermally pumped to produce a divergent oscillatory out-of-plane motion. Developed were two mathematical thermoelastic models of this phenomenon. Analysis substantiates the contention that the anomalous motion of the OGO-4 spacecraft was caused by an unstable, thermally induced oscillation of its open-section boom. The two- to three-orders-of-magnitude improvement in torsional rigidity (measured on several configurations having seams zippered by inter-locking tabs) indicates that zippering the boom is the most practical way to avoid the thermally induced instability. Author

N70-12231# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON VARIATIONAL PRINCIPLES OF DYNAMIC SHELL THEORY
L. Ainola 22 Feb. 1968 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk Est. SSR, Fiz.-Mat., v. 17, no. 3, 1969 p 283 - 289
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A Legendre transformation is carried out on a variational principle which is equivalent to the equations and relationships, as well as to boundary and initial conditions of a linear Timoshenko type theory of elastic shells, and a variational principle is derived which is the analog of the Castigliano principle in shell statics. It is shown that this principle is equivalent to the equations of motion, boundary, and initial conditions of a shell theory formulated just by using stress resultants and moments. Author

N70-12232# Lockheed Missiles and Space Co., Palo Alto, Calif.
AXISYMMETRIC NONSTATIONARY STRAIN PROCESSES OF SHELLS OF REVOLUTION
N. Veksler 24 Jul. 1967 7 p refs Transl. into ENGLISH from Izd. Akad. Nauk Est. SSR, Fiz.-Mat., v. 17, no. 1, 1969 p 34 - 70
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Axisymmetric nonstationary strain processes of toroidal and conical shells, as well as the limiting cases of a conical shell, a cylindrical shell, and a circular slab, which are caused by abrupt dynamic edge effect, are investigated on the basis of a Timoshenko type theory of shells. The numerical computations carried out show that in the initial stage of motion the dominant factors of the transient, the displacements, stress resultants, and moments (tangential for tangential edge effects and non-tangential for bending and shear edge effects) are similar for shells of revolution of different geometrical shape, and their differences are mainly determined by the difference in shell stiffness (the radius of the tubular rod). The secondary factors for shells of revolution of different geometric shape are considerably diverse. The curvatures of the shell middle surface (along the parallel, meridian, and also Gaussian) have almost no effect on the nature of the nonstationary strain process. Author

N70-12324*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
FLUTTER DESIGN OF STIFFENED-SKIN PANELS FOR HYPERSONIC AIRCRAFT
Herman L. Bohon, Melvin S. Anderson, and Walter L. Heard, Jr. Washington Dec. 1969 28 p refs
(NASA-TN-D-5555) Avail: CFSTI CSCL 20K

Factors which control the flutter design for exterior skin panels of hypersonic vehicles are reviewed. From a typical trajectory the most critical flight regime is identified in the supersonic range. Because past studies have shown that support flexibility can seriously reduce the flutter margin of panels such as those proposed for hypersonic vehicles, conservative design curves for such panels with flexible supports are presented. Means of greatly improving flutter margins by the addition of torsional restraint at the panel edges are also indicated. Author

N70-12325*# Lehigh Univ., Bethlehem, Pa.
SOME ASPECTS OF FATIGUE CRACK PROPAGATION
Richard Roberts and John J. Kibler Jul. 1969 32 p refs
(Grants NGR-39-007-011; NSF GK-1225)
(NASA-CR-66829) Avail: CFSTI CSCL 20K

The models of fatigue crack propagation proposed by Forman et al and Roberts and Erdogan were studied in this paper. By applying these models to existing data in the literature for thin 2024-T3 and 7075-T6 aluminum plates subjected to fluctuating tensile loads, it was found that both models gave comparable results when one considered just a gross correlation of the experimental data. By modifying Forman's model to incorporate the ideas of Roberts and Erdogan, a model was produced which appeared to be a more rational basis for studying the problem of fatigue crack propagation in thin plates and shells subjected to tensile loads, bending loads, or a combination of both. This fact was demonstrated for the case of thin plates subjected to fluctuating bending loads and for the case of thin cylindrical shells subjected to fluctuating internal pressure. Author

N70-12344# Krupp (Fried.) G.m.b.H., Rheinhausen (West Germany). Maschinen- und Stahlbau.
LATERAL BUCKLING OF YIELDING ARCHES WITH RECTANGULAR CROSS SECTION [PLASTISCHES KIPPEN VON BOEGEN MIT RECHTECKQUERSCHNITT]
W. Protte *In its* Krupp Tech. Inform. Res. Rept., Vol. 27, No. 1 May 1969 p 1-10 refs In GERMAN; ENGLISH summary (See 70-12343 02-34)
Avail: CFSTI

The failure load of arches is investigated, using first and second order approximations. The lateral buckling load is then calculated by determining the depth of plasticisation under an assumed load and using the residual cross sections remaining within the plastic range in the subsequent stability calculation. The value of the assumed load is varied iteratively until satisfactory agreement with the lateral buckling load. Author (ESRO)

N70-12391# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.
TIME-HARMONIC TRANSVERSE AND LONGITUDINAL MOTIONS OF A LAMINATED PLATE
C. T. Sun (Purdue Univ.) and J. D. Achenbach Jul. 1969 29 p refs
(Contract Nonr-1228(34))
(AD-693200; TR-69-1) Avail: CFSTI CSCL 13/13

An approximate theory, which describes the mechanical behavior of a laminated medium as that of a homogeneous continuum with microstructure, is employed to study time-harmonic motions of a laminated plate. For the lowest flexural and extensional

modes, the phase velocities and the frequencies are computed as functions of the wave number. A comparison with exact results shows good qualitative agreement. By contrast, corresponding results according to the effective modulus theory agree only for small values of the wave number, for which the dispersive behavior results from the overall thickness of the plate. As the wave number increases (wave length decreases) the dispersion due to the internal layering becomes more pronounced, causing the phase velocity to increase as the wave number increases. The latter effect cannot be described by the effective modulus theory. Author (TAB)

N70-12402# California Univ., La Jolla. Dept. of Aerospace and Mechanical Engineering Sciences.
SIMILARITY SOLUTIONS FOR EXPANSION OF A HOLE IN ANISTROPIC PLASTIC DISKS
Jenn-Ming Chern and S. Nemat-Nasser Aug. 1969 47 p refs
(Contract N00014/-67-A-0109)
(AD-693138; TR-32) Avail: CFSTI CSCL 20/11

Similarity solutions are obtained for the expansion of a circular hole with zero (pin-hole) or finite initial radius in an infinitely extended, axisymmetric, anisotropic disk of a non-uniform initial thickness. A linear workhardening law is used together with Mises and Trescas yield conditions. A complete closed-form solution is developed for Trescas yield condition and its associated flow rule. Similar results are obtained for Mises yield condition and its associated flow rule; these results are not, however, in a closed-form. Two illustrative examples are worked out in detail to demonstrate the basic results, especially the effects of anisotropy and workhardening. Author (TAB)

N70-12490# Stanford Research Inst., Menlo Park, Calif.
STRESS WAVE PROPAGATION IN A PRESTRESSED MEDIUM Final Report, 1 Oct. 1968 – 31 Jul. 1969
Riho H. Martinson Jul. 1969 32 p refs
(Contract F19628-69-C-0010)
(AD-693218; AFCRL-69-0302) Avail: CFSTI CSCL 20/11

Photoelastic calibration experiments were performed on 1/8 inch thick sheets of Pyrex and Plexiglas to determine the apparent colors of these materials when stressed and viewed in white light in a circular polariscope. The results of dynamic strain gage experiments show that clearly defined P wave radiation patterns are emitted from explosive sources in stressed sheets of Pyrex and Plexiglas. Author (TAB)

N70-12498*# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
NUMERICAL ANALYSIS OF SHELLS. VOLUME 1: UNSYMMETRIC ANALYSIS OF ORTHOTROPIC REINFORCED SHELLS OF REVOLUTION
V. Svalbonas Sep. 1969 106 p refs
(Contract NAS8-21113)
(NASA-CR-61299) Avail: CFSTI CSCL 20K

A general theory is described for the analysis of thin orthotropic shells of revolution subjected to unsymmetric loading. The various shell geometries that can be considered are: ellipsoid, ogive, paraboloid, cylinder, cone, or any selected special geometry. The theory also treats a wide variety of shell reinforcing including eccentric and rotated waffle construction. A digital computing system based on this theory is formulated utilizing a Fourier series expansion in the circumferential direction and numerical integration in the meridional direction. The ensuing program requires simple, yet general, input procedures and produces readily usable output data. Author

N70-12499*# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
NUMERICAL ANALYSIS OF SHELLS. VOLUME 2: USER'S MANUAL FOR "STARS-2": SHELL THEORY AUTOMATED FOR ROTATIONAL STRUCTURES-2, DIGITAL COMPUTER PROGRAM
V. Svalbonas and N. Angrisano Sep. 1969 179 p refs
(Contract NAS8-21113)
(NASA-CR-61300) Avail: CFSTI CSCL 20K

The information necessary for the application of the STARS 2 (Shell Theory Automated for Rotational Structures 2) program is presented. The fundamental structural theory is detailed in volume I of this series. Author

N70-12500*# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
NUMERICAL ANALYSIS OF SHELLS. VOLUME 3: ENGINEER'S PROGRAM MANUAL FOR "STARS-2": SHELL THEORY AUTOMATED FOR ROTATIONAL STRUCTURES-2, DIGITAL COMPUTER PROGRAM
N. Angrisano, F. Hughes, and V. Svalbonas Sep. 1969 129 p
(Contract NAS8-21113)
(NASA-CR-61301) Avail: CFSTI CSCL 20K

This manual contains engineering programming information for the STARS 2 (Shell Theory Automated for Rotational Structures 2) digital computer program. The report is written for the engineer who will need to make small alterations to the program, such as incorporating a new geometry or altering a table size, to fit his specific needs. The sections of the manual each cover one major subroutine. These sections are further subdivided in the following manner where applicable: subroutine description; a list of pertinent engineering symbols and their FORTRAN coded counterparts; subroutine flow chart; and subroutine FORTRAN listing. Author

N70-12512# Aerospace Corp., El Segundo, Calif. Lab. Operations.
UNIAXIAL-STRAIN WAVE-PROPAGATION EXPERIMENTS USING SHOCK-TUBE LOADING Technical Report, Aug. 1967 – May 1969
Gerald Commerford and James S. Whittier 18 Aug. 1969 33 p refs
(Contract F04701-69-C-0066)
(AD-693130; TR-0066-5240-30-1; SAMSO-TR-69-277) Avail: CFSTI CSCL 14/2

A technique for studying uniaxial strain pulse propagation is discussed. The face of a disk-shaped sample is loaded uniformly with step-function pressure by reflection of a gasdynamic shock wave. The effect of propagation through the sample on the step pulse is observed by use of measurements of the velocity of the samples rear surface made with a capacitive transducer. Data are presented for several materials. The technique is advantageous for study of pulse dispersion mechanisms such as bulk viscoelasticity and heterogeneous microstructure. Author (TAB)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N70-11424# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
SOLUTION OF A GENERALIZED THREE-DIMENSIONAL PROBLEM ON RADIATION TRANSFER IN AN ABSORBING AND AN ISOTROPICALLY SCATTERING MEDIUM
Yu. A. Surinov 20 May 1969 38 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Izv., Energ. i Transp. (USSR), no. 2, 1968 p 71 – 96
(Contract NOw-62-0604-C)
(AD-692928; APL-CLB-3-T-589) Avail: CFSTI CSCL 20/13

Studies is a three-dimensional problem of radiation transfer and radiative heat exchange in a system consisting of bounded gray bodies separated by an absorbing and anisotropically scattering medium. Solutions are given for a generalized and three specific statements of the problem. The generalized statement is described by a system of two integral equations containing generalized characteristics of the boundary and volume radiation. With the aid of closure equations derived from the second law of thermodynamics it is shown that all statements of the problem have a unique solution. A new method is given for the numerical calculation of local characteristics of the radiation field in a continuously discrete case. New concepts are introduced, such as local and average resolving angular coefficients of radiation, attenuation methods of the medium, etc. Author (TAB)

N70-11494# Stanford Univ., Calif. Dept. of Mechanical Engineering.
TEMPERATURE EFFECTIVENESS OF MULTIPLE SANDWICH RECTANGULAR PLATE-FIN SURFACES
R. K. Shah 1 Jul. 1969 76 p refs
(Contract Nonr-225(81))
(AD-693543; TR-71) Avail: CFSTI CSCL 13/1

The temperature effectiveness for ten fin configurations of straight rectangular multiple sandwich plate-fin surfaces has been evaluated. These surfaces are of the type employed in compact heat exchangers. The effect of matching and mismatching of passages of double and triple sandwich fins has been investigated and has shown to be negligible. A refined method is outlined to determine the surface effectiveness of a triple sandwich fin. Author (TAB)

N70-11620# Martin Co., Orlando, Fla.
COMBUSTION CHEMISTRY OF HIGH ENERGY PYROPHORIC FUELS Final Report
Charles A. Andrade 26 May 1969 116 p refs
(Contract AF 49(638)-1566)
(AD-693325; OR-10119; AFOSR-69-2197TR) Avail: CFSTI CSCL 21/2

The research reported is directed toward further understanding of the fundamental processes in supersonic combustion. Part One describes a branching chain mechanism constructed for oxy-diborane mixtures diluted in argon. Included in this postulated mechanism is the production of hydroxyl as an ignition intermediate. A spectrograph was used to view the oxy diborane system through the end plate of a single pulse shock tube. Hydroxyl and several boron intermediates were identified, qualitatively verifying both mechanism and equilibrium calculations. Ignition induction measurements were performed up to 950K behind the reflected shock wave. These measurements extend previously known data by two orders of magnitude in the induction time. Part Two of this report describes the CAL Nonequilibrium Normal Shock Wave Program which was extended for use with highly exothermic branching chain reactions, checked out with known hydrogen oxygen kinetics, and reformulated to include transport and radiative energy transfer mechanisms. Author (TAB)

N70-11626# Kansas State Univ., Manhattan. Dept. of Chemical Engineering.
HEAT TRANSFER TO AN MHD FLUID Final Technical Report, 1 Oct. 1967 – Apr. 1969
L. T. Fan and C. L. Hwang Jun. 1969 9 p refs
(Grant AF-AFOSR-1410-68)
(AD-693330; AFOSR-69-2175TR) Avail: CFSTI CSCL 10/2

For the design of MHD devices - accelerators and generators, the calculation of the various losses is important. Among others, of great importance is the heat transfer to the walls of the channel and the electrodes. A study was made to investigate theoretically and numerically the magnetohydrodynamic channel-flow with the forced-convection heat transfer and the optimal design of MHD devices. Author (TAB)

N70-11640# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INFLUENCE OF EVAPORATION OF FUEL ON THE IGNITION DELAY OF TWO-PHASE MIXTURES
A. V. Kudryavtsev 18 Jun. 1969 8 p refs Transl. into ENGLISH from Akad. Nauk Ukr. RSR, Fiz. Goreniya (Kiev), 1966 p 94–103
(AD-693454; FTD-HT-23-289-68) Avail: CFSTI CSCL 21/2

An analysis was made of the ignition process of dispersed fuel-air mixtures, and formulas were derived for calculating the ignition delay times under various conditions. For the case where the evaporation time of the droplet is smaller or approximately equal to the induction period, a formula was derived for the ignition delay time and formulas for the effect of pressure and air excess coefficient were also derived. Author (TAB)

N70-11683# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
SOLUTIONS OF DIFFERENTIAL EQUATIONS FOR THERMAL STRESS ANALYSIS OF A SPHERICAL NOSECAP
M. B. Tate Apr. 1969 21 p refs
(Contract NOw-62-0604-C)
(AD-693032; TG-1070) Avail: CFSTI CSCL 17/9

General solutions for the shearing-stress resultant and change in slope of a nosecap wall are obtained and described. These are the basic functions that are required in the calculation of thermal stresses. They are obtained in the form of infinite series. Particular solutions for the two functions are obtained also. Sets of coefficients for the series are determined from recurrence formulas that are well suited to computer programming. In numerical work, two-hundred terms were employed in each sum to evaluate it at several points along the span of the nosecap. TAB

N70-11773 Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
THERMAL ENTRANCE REGION HEAT TRANSFER FOR RECTANGULAR DUCTS OF VARIOUS ASPECT RATIOS AND PECLET NUMBERS Final Report, Sep. 1966 – Jun. 1968
J. R. Dewitt and W. T. Snyder Sep. 1969 89 p refs Prepared by ARO, Inc.
(Contract F40600-69-C-0001)
(AD-693564; AEDC-TR-69-115) Avail: CFSTI CSCL 21/5

In this investigation the thermal entrance region problem is solved for flow in rectangular ducts of various aspect ratios and for various Peclet numbers. The assumptions under which the problem is solved are steady, fully developed laminar velocity profile, constant fluid properties of viscosity, density, specific heat and thermal conductivity, constant wall temperature, and a uniform inlet fluid temperature. Included in the solution are axial conduction and viscous dissipation. The method of B. G. Galerkin is used to formulate an approximate series solution of the problem. The data presented include bulk mean temperature, local Nusselt number, and the ratio of the local heat-transfer rate to the long wall to the local heat-transfer rate to the short wall. It is concluded that for low Peclet numbers, neglecting the axial conduction term leads to considerable error in the solution. Author (TAB)

N70-11818# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
FLAMMABILITY OF LEADED DRY BOX GLOVES
Thomas C. Johnson and John W. Lindsay 9 Jun. 1969 8 p refs
(Contract AT(29-1)-1106)
(RFP-1354) Avail: CFSTI

An investigation of the flammability of dry-box gloves reveals that a potential fire hazard exists in the use of leaded dry-box gloves in nitric acid environments. Author (NSA)

N70-11910*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LARGE-AMPLITUDE RESONANT COMBUSTION IN LIQUID ROCKET ENGINE CHAMBERS: SOME ASPECTS OF INITIATION
A. A. Kovitz 15 Nov. 1969 21 p refs
(Contract NAS7-100)
(NASA-CR-106960; JPL-TR-32-1377) Avail: CFSTI CSCL 21B

The initiation of large-amplitude, high-frequency resonant combustion in rocket chambers is considered as the result of a finite disturbance. It is shown that a relatively low-energy blast wave can initiate a spherical detonation wave, which may act as the source of such instability. The wave's interaction with a hot-cool gaseous interface and subsequent reflection from the chamber wall can produce the high amplitudes observed. A descriptive explanation of the transition from spherical detonation to a rotating combustion-driven wave is presented. The analysis suggests that high temperatures, nearly combustion, and nonsymmetrical conditions within the chamber are likely to lead to the sudden initiation of resonant burning. Author

N70-11926# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INSTALLATION FOR HIGH-TEMPERATURE INVESTIGATIONS OF HEAT RESISTANT AVIATION MATERIALS AND COATINGS
V. V. Pasichnyi et al 4 Jun. 1969 15 p refs Transl. into ENGLISH from Samoletostroenie i Tekhn. Vozdushnogo Flota (USSR), n. 10, 1967 p 77-83
(AD-692635; FTD-MT-24-504-68) Avail: CFSTI CSCL 14/2

Helioapparatus and the method for and results of determining the thermal parameters of aviation materials are described. The apparatus produces a temperature of up to 1500-2000C, which is measured with great accuracy by thermocouples. Radiation is measured with an AT-50 actinometar and a GSA-1 galvanometer. The redistribution of thermal-flux density in the focal zone is analyzed when the temperature is controlled by a shielding cylinder and by defocusing. Strict determination of the thermal flux incident on the specimen and its distribution over the heating area is found to be important. The apparatus allows experiments to be made under very pure conditions and at easily controllable temperatures and thermal fluxes. Author (TAB)

N70-11935# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
DIFFUSION FLAMES AND SUPERSONIC COMBUSTION Final Scientific Report, Apr. 1967 – Apr. 1968
I. Da Riva, A. Linan, E. Fraga, and J. Urrutia Jun. 1969 33 p refs
(Grant AF-EOAR-43-67)
(AD-693341; AFOSR-69-2165-TR) Avail: CFSTI CSCL 21/2

The method of matched asymptotic expansions has been used for the analysis of the H2-Air reaction in the temperature and pressure range of interest to Supersonic Combustion. The use of the method is advantageous because of the large differences in the rate constants of the elementary reactions appearing in the reaction mechanism. The ratios between the rate constants are used as the small or large parameter in the perturbation method. Several stages are found in the course of the reaction and at each stage only a small number of the elementary reactions play an important role. Different expansions are used for each stage, and they are matched according to the rules of the method of matched asymptotic expansion of Kaplun, Lagerstron, etc. For the zeroth order approximation, at each stage, the reaction mechanism is very often drastically simplified. This occurs because some of the elementary reactions are frozen while others are at equilibrium; some species are not changing at a given stage, while others take a quasi-steady state value. Very often an overall reaction rate may be used for the zeroth order approximation at each stage. The method of matched asymptotic expansions allows to determine how the appropriate overall reaction rate changes with the succesive stages of the reaction and with the initial stoichiometry of the mixture. Author (TAB)

N70-11970# California Univ., Livermore. Lawrence Radiation Lab.
STANDARD TEST FOR DETONATION PRESSURE MEASUREMENT
John C. Cast, Howard C. Hornig, and John W. Kury 12 Jun 1969 13 p refs
(UCRL-50645) Avail: CFSTI

A standard test for measuring the detonation pressure o an explosive is described. Measured pressures are given for the following four explosives: TNT, 190 kbar; Comp B-3, 300 kbar LX-04-1, 350 kbar; and PBX-9404, 375 kbar. Author (NSA

N70-11983# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
THEORETICAL AND EXPERIMENTAL ANALYSIS OF A THERMAL STRESS PROBLEM IN TUBE SHEET DESIGN
Thomas Slot Apr. 1969 45 p refs Presented at 1st Intern. Conf. on Pressure Vessel Technol., Delt, Netherlands, 29 Sep. – 2 Oct. 1969
(Contract W-31-109-eng-52)
(KAPL-P-3837; Conf-690906-1) Avail: CFSTI

Stresses produced in the tube sheet of heat exchangers of the U-tube type by a temperature differential across the divider land between inlet side and outlet side are examined. Results reported from photoelastic experiments show that the highest stresses occur within the first few rows of holes adjacent to the divider lane and that the distribution of stresses tends to be repetitive from hole to hole along these rows. Analytical procedures are presented for evaluating stresses in thin and thick tube sheets. Good agreement is demonstrated between predicted and measured stresses for thick tube sheet models. Author (NSA)

N70-12278*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
EXPLORATOR HEAT-TRANSFER MEASUREMENTS AT MACH 10 ON A 7.5 DEG TOTAL-ANGLE CONE DOWNSTREAM OF A REGION OF AIR AND HELIUM TRANSPIRATION COOLING
James C. Dunavant and Philip E. Everhart Washington Dec. 1969 31 p refs
(NASA-TN-D-5554; L-6181) Avail: CFSTI CSCL 20M

The heat transfer to a 7.5 deg total-angle cone at a Mach number of 10 was measured to determine the far downstream effects of injecting air and helium into the cone boundary layer through a porous section near the apex. Transpiration rates varied from 0.0003 to 0.0084 times the flow rate through a stream tube equal to the maximum diameter of the model. The transpiration of both air and helium at these rates produced large increases in the pressure ratio over the transpiration region and expansion just downstream of the porous section to pressures well below those measured without transpiration. Over the rear half of the cone, the surface pressures returned to within approximately 10 percent of the pressure on the cone without transpiration. Large decreases in the heating were obtained just downstream of the transpiration region and resulted from injection of even small masses of coolant. Boundary layer transition occurred earlier with air transpiration but was unaffected by helium transpiration. Where the flow was already turbulent, transpiration of air did not decrease the heating rates but helium caused a small decrease. Author

N70-12284# National Physical Lab., Teddington (England). Div. of Chemical Standards.
THE THERMODYNAMIC PROPERTIES AND THE EQUILIBRIUM DIAGRAM OF THE SYSTEM CHROMIUM-IRON

Franz Müller Sep. 1969 19 p refs Sponsored by Deut. Forsch. Gemeinschaft
(NPL-DCS-4) Copyright. Avail: CFSTI

A re-assessment of the thermodynamic properties, including the phase boundaries, of the system iron-chromium is presented. Heat of formation, for both alpha and sigma phases, excess entropy of solution of chromium in liquid chromium and phase transformation are discussed. Both solid and liquid alloys are considered and the equilibrium diagram is analyzed. ESRO

N70-12308*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRANSIENT CONFORMAL MAPPING METHOD FOR TWO-DIMENSIONAL SOLIDIFICATION OF FLOWING LIQUID ONTO A COLD SURFACE
Marvin E. Goldstein and Robert Siegel Washington Dec. 1969 72 p refs
(NASA-TN-D-5578) Avail: CFSTI CSCL 20M

A method was developed to analyze the transient formation of a two-dimensional solidified region. The transient shapes of the frozen region are found by mapping the region into a potential plane and then determining the time varying conformal transformations between the potential and physical planes. The method is applied to analyze solidification on a cold plate of finite width immersed in flowing liquid having a bulk temperature above the freezing point. The transient results are compared with a quasi-steady solution in which the frozen region boundaries pass instantaneously through steady state shapes. Author

N70-12320*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMODYNAMIC PROPERTIES OF LIQUID METAL SOLUTIONS IN THE CESIUM-MERCURY SYSTEM
Albert C. Antoine Washington Dec. 1969 15 p refs
(NASA-TN-D-5577) Avail: CFSTI CSCL 20M

Measurements were made of the electromotive force of cesium–cesium amalgam cells, over the composition range from 0.05 to 0.15 atomic fraction cesium and at temperatures of 215 deg, 240 deg, and 265 deg C (488, 513, and 538 K). Activities, partial and excess partial free energies and entropies, and partial molar heats of mixing of cesium in cesium amalgam were calculated. The thermodynamic data for the other solution component, mercury, as well as integral values, were also obtained. Substantial deviations from the laws of ideal dilute solutions occur. These deviations can be explained quantitatively on the basis of specific compound formation. Author

N70-12348# Battelle-Northwest, Richland, Wash. Metallurgy and Ceramics Dept.
IRRADIATION OF GRAPHITE AT TEMPERATURES OF 300 TO 1200 DEG C
J. W. Helm Jun. 1969 98 p refs
(Contract AT(45-1)-1830)
(BNWL-1056-A) Avail: CFSTI

A large variety of graphites have been irradiated at temperatures from 300 to 1200 C to maximum neutron fluxes of 2.7 ×10 to the 22nd power nvt. As temperatures and neutron fluxes increased, bulk expansion of the graphite became the controlling behavior in all orientations. Materials that were well graphitized, highly crystalline, isotropic, and had a high coefficient of thermal expansion showed the lowest contraction at moderate fluxes. The dimensional change data for all graphite types may be separated into two bands. The first band represents data for samples irradiated in the temperature range 300 deg to 800 deg C. The second band, showing a highly accelerated damage rate, represents data for samples irradiated at 900 deg to 1200 deg C. Thus, the transition from the lower damage rate to the higher one takes place over narrow temperature range. The data are grouped closely within each band. These observations are based on relatively small samples, generally less than 1/2 in. diameter by less than 4 in. long. While the behavior of these small samples may not exactly represent the behavior of larger pieces, it is felt that expansion will ultimately be the controlling behavior in the larger sizes also. Author (NSA)

N70-12355# Krupp (Fried.) G.m.b.H., Essen (West Germany). Chemieanlagenbau und Rechenzentrum.
DESIGN OPTIMIZATION OF SHELL-AND-TUBE HEAT EXCHANGERS USING AN ELECTRONIC COMPUTER [OPTIMALE AUSLEGUNG VON ROHRBUENDELWAERMEAUSTAUSCHERN MIT EINER ELEKTRONISCHEN RECHENANLAGE]
H. Gelbe, V. Tierling, and H.-P. Paulsen *In its* Krupp Tech. Inform. Eng. Rept., Vol. 27, No.2 Jun. 1969 p 87–92 refs In GERMAN; ENGLISH summary (See N70-12351 02-34)
Avail: CFSTI

A program for the optimum design of the tube manifold heat exchangers for gaseous and liquid media without a change in the aggregate state is described. The program selects, by means of a variation of several design variables, the design with a minimum exchange surface, satisfying certain hydrodynamic and design requirements. The course of the calculation is demonstrated by means of a flow chart and numerical examples. Author (ESRO)

N70-12496# Atomic Energy Establishment, Winfrith (England). SGHW Development Div.
FREON 7-ROD CLUSTER SUBCHANNEL MIXING EXPERIMENTS
R. W. Bowring and J. Levy May 1969 25 p refs
(AEEW-M-906) Avail: CFSTI

The subchannel thermal-hydraulic characteristics of a 7 rod cluster were measured using boiling Freon-12, modeling water at 1,000 psia. The heated length was 36 in., the rod diameter 0.625 in. and rod gap 0.060 in. The following were determined from the experiments: lateral resistance to cross flow, the diversion length, cross-flow enthalpy, the fraction of heat retained in the highly rated subchannel, and the turbulent mixing factor, Fm, used in HAMBO. The mixing factor was found to decrease when boiling started, but was then independent of vapor quality, within the experimental error. It also decreased more rapidly with mass velocity in the boiling than in the nonboiling regime. The cross flow enthalpy was found to be a continuous function with cross flow and not that of the donor subchannel; the enthalpy appeared to be intermediate between that of the two subchannels but the possibility of steam enhancement could not be discounted. Author (NSA)

N70-12504# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL DECOMBUSTION AND COMBUSTION OF EXPLOSIVES
K. K. Andreyev 14 Jul. 1969 99 p refs Transl. into ENGLISH from Term. Razlozhenie i Gorenie Vzryvchatykh Veschestv. (Moscow), 1966 p 12–100, 260–293, 345–346
(AD-693600; FTD-HT-23-1329-68) Avail: CFSTI CSCL 19/1

This book essentially presents a review and summary of experimental and theoretical findings obtained in the field of combustion processes in explosives. The author, who died before completing his review of the book for publication, was one of the foremost Soviet specialists in the field, and many of the findings and basic principles cited in the book are either his or those of his school. This is particularly true with respect to the material on the theory of combustion and thermal disintegration of secondary explosives, and the analysis of critical phenomena and to the physical essence of the difference between the properties of a number of explosives. Briefly summarized, the book is concerned with the principal forms of explosives and their capacity for chemical conversion i.e., stable combustion, nonsteady state combustion, and detonation, the main problems of chemical kinetics in the

initiation and development of an explosion as a function of changes in temperature, and the slow combustion of principally condensed substances. The book is intended for students, engineers and scientific workers specializing in physical chemistry and chemistry.
Author (TAB)

N70-12511# Purdue Univ., Lafayette, Ind.
COMBUSTION OF BORON PARTICLES AT ATMOSPHERIC PRESSURE
Andrej Macek and J. Mc Kenzie Semple Aug. 1969 35 p refs
(Contract N00014-67-A-0226; Proj. SQUID)
(AD-693055; SQUID-TR-ARC-12-PU) Avail: CFSTI CSCL 21/2

Single particles of pure crystalline boron were injected into streams of hot oxidizing gases, generated by a gas-burner, at atmospheric pressure. Two powder samples, having average diameters of 34.5 and 44.2 microns respectively, were studied. Gas temperatures were varied from 1800 to 2900K, mole fractions of oxygen from 0.08 to 0.37, and mole fractions of water from 0 to 0.21. Qualitative photographic and spectroscopic observations of the particle combustion process are described. Ignition temperatures of boron particles, 1850 to 2000K, were found to be independent of particle size and of gas temperature, but affected by the composition of ambient gases. Burning times, ranging from 10 to 40 msec, were found to be inversely proportional to the mole fraction of oxygen in the gas, to decrease slightly with increasing gas temperature, and to decrease substantially with addition of water vapor. Experimentally determined burning rates are correlated with diffusion rates of gaseous oxidants to the surface of the burning particle.
Author (TAB)

N70-12517# Los Alamos Scientific Lab., N. Mex.
MEASUREMENT OF PYROCARBON THERMAL CONDUCTIVITY BY THE FISSION COUPLE METHOD
Peter G. Salgado, Fred P. Schilling, and Gerald T. Brock 31 Mar. 1969 16 p refs
(Contract W-7405-eng-36)
(LA-4165) Avail: CFSTI

A technique for measuring the thermal conductivity of the pyrocarbon coatings of coated particle fuel is described. The nuclear fuel particles were overcoated with tungsten, and thermocouple wires were welded 180 deg apart to the tungsten. These intrinsic thermocouples (fission couples) were subjected to neutron bursts and the surface temperature responses were monitored. If particle dimensions and burst shape are known, the effective thermal conductivity of the pyrocarbon coats can be calculated. Experiments were conducted to measure the conductivity of a low-density pyrocarbon buffer coat. Comparisons were made between values obtained by the fission couple method and the xenon flash method for two dense pyrocarbons.
Author (NSA)

N70-12575# Union Carbide Corp., Indianapolis, Ind. Linde Div.
RESEARCH AND DEVELOPMENT IN A THERMAL INSULATION STUDY Quarterly Progress Report, Mar.–May 1969
W. E. Grunert and H. Morihara May 1969 51 p refs
(Contract AT(30-1)-3632)
(ALO-3632-41) Avail: CFSTI

Updated results of long-term stability tests on the 1800 F composite and nickel opacified quartz multilayer insulation systems are presented. Performance deteriorations, ranging from 6% on the 1800 F composite (1000-hours operation) to 16% on the nickel opacified system (6000-hours operation), have been noted. Potential causes and subsequent investigation of this long-term deterioration are discussed. The retest program on aluminum-glass multi foil and glass fibrous multi layer insulations is complete. Apparent thermal conductivity data are presented at various temperatures and compressive loads. Thermal behavior of this class of multi layer insulations is discussed. The current status of the penetration effects test program is discussed. Testing difficulties have been traced to excessive interface resistance between the lead telluride penetrations and system thermal boundaries. Design changes to alleviate this problem are described.
Author (NSA)

N70-12626*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
BURN RATE TESTING APPARATUS Patent Application
Frederick S. Dawn, inventor (to NASA) and William L. Gill, inventor (to NASA) Filed 28 Aug. 1969 19 p
(NASA-Case-XMS-09690-1; US-Patent-Appl-SN-853841) Avail: CFSTI CSCL 20M

An apparatus for testing the burn rate between two spaced apart points on a sample of material is described. It includes an angularly adjustable support holder, an electrically ignited torch supplied with an independent supply of oxygen, a flame shutter between the torch and the sample holder and photocells positioned to sense ignition of the test material and the rate of burn between two spaced apart points on the material.
NASA

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N70-11495*# National Academy of Sciences-National Research Council, Washington, D.C.
THE INVISIBLE UNIVERSITY: POSTDOCTORAL EDUCATION IN THE UNITED STATES
1969 330 p refs Sponsored by NASA, Alfred P. Sloan Found., Natl. Inst. Gen. Medical Sci., Natl. Endowment Humanities, NSF, and Office of Educ.
(NASA-CR-106799) Avail: CFSTI CSCL 05I

The composition of the postdoctoral population in the United States was investigated, as well as the significance of postdoctoral education for the individual, the department, and the institution of which he is temporarily a member; its cost; and the manner in which it is supported. The major purpose of postdoctoral education is concluded to be an initial acceleration of the development of an independent investigator capable of training others in research, followed by concentration of the pursuit of research and scholarship. Removal of restrictions for postdoctoral selection of mentors at industrial research laboratories is recommended. Increased allotment of space in facilities, and financial support for research and optimum exploitation of senior and intermediate postdoctoral opportunities are also recommended. Foreign participation in postdoctoral education and American postdoctoral travel abroad are encouraged. Examples of questionaires used in the study are included, along with tables showing distribution of postdoctoral fields within institutions and academic disciplines.
J.A.M.

N70-11582*# Indiana Univ. Foundation, Bloomington. Aerospace Research Applications Center.
AN INVESTIGATION INTO THE INFORMATION HABITS OF SCIENTISTS AND ENGINEERS IN INDUSTRY
Robert W. Hall (Tenn. Univ.) Oct. 1969 16 p refs
(Grant NSR-15-003-076)
(NASA-CR-106832) Avail: CFSTI CSCL 05A

Three different types of individuals in industrial research and development work were compared with a control group on the basis of their information habits and a few related personal characteristics to uncover ways of increasing and improving usage of information center services. The groups consisted of (1) top performers, (2) technological gatekeepers or informal consultants, and (3) ARAC information system users. The control group was chosen at random. The results are given in tabular form on

performance characteristics, technical information source preferences, time spent reading six different types of literature, and comparative usage of different information sources. J.A.M.

N70-11942*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PUBLICATIONS OF THE JET PROPULSION LABORATORY, JULY 1968 THROUGH JUNE 1969
31 Oct. 1969 75 p refs
(Contract NAS7-100)
(NASA-CR-106958; JPL-Bibl-39-10) Avail: CFSTI CSCL 05B

An annotated bibliography of technical reports, technical memoranda, and other publications is presented. Three volumes of the Space Programs Summary are cited. A subject index includes entries on antennas and transmission lines, computer programs, fluid mechanics, mathematical sciences, advanced planetary exploration, and power sources. M.H.E.

N70-12140# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS
William M. Leak, ed. Oct. 1969 39 p refs
Avail: CFSTI

CONTENTS:

1. SCATTERING OF ACOUSTIC PULSES BY A RIGID SPHERE IN A FLUID A. J. Rudgers p 1–14 refs (See N70-12141 02-23)

2. PROBLEM NOTES p 15–31 refs (See N70-12142 02-23)

3. THE DESIGN OF AN INEXPENSIVE MULTICHANNEL PROGRAMMED RECORDER A. W. Baldwin and C. E. Carson p 32–35 (See N70-12143 02-09)

N70-12193*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-58, VOLUME 3 FOR THE PERIOD 1 JUNE–31 JULY 1969. SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
31 Aug. 1969 240 p refs
(Contract NAS7-100)
(NASA-CR-107040; JPL-SPS-37-58-Vol-3) Avail: CFSTI CSCL 05B

A review of technical information resulting from current engineering and scientific work performed, or managed by the Jet Propulsion Laboratory is presented. Included are the research developments in the following areas: (1) space sciences division, (2) telecommunication division, (3) guidance and control division, (4) engineering mechanics division, (5) environmental sciences division, (6) propulsion division, and (7) mission analysis division. F.O.S.

N70-12343# Krupp (Fried.) G.m.b.H., Essen (West Germany).
KRUPP TECHNICAL INFORMATION. RESEARCH REPORTS, VOLUME 27, NUMBER 1 [TECHNISCHE MITTEILUNGEN KRUPP. FORSCHUNGSBERICHTE, BAND 27, HEFT 1]
May 1969 37 p refs In GERMAN; ENGLISH summaries
Avail: CFSTI

CONTENTS:

1. PLASTIC BUCKLING OF ARCHES WITH RECTANGULAR CROSS SECTION W. Protte p 1–10 refs (See N70-12344 02-32)

2. AUTOMATIC X-RAY DIFFRACTION ANALYSIS J. Willbrand p 11–12 (See N70-12345 02-14)

3. TEMPERATURE VARIATION IN KILLED STEEL INGOTS DURING SOLIDIFICATION, COOLING AND REHEATING IN THE SOAKING PIT FURNACE K. Müller, P. Hammerschmid, and P. Funke, Jr. p 13–26 refs (See N70-12346 02-17)

4. REPROCESSING OF IRRADIATED NUCLEAR FUELS CONTAINING THORIUM J. Hartwig and K. H. Ulrich p 27–36 refs (See N70-12347 02-22)

N70-12351# Krupp (Fried.) Krupp G.m.b.H., Essen (West Germany).
KRUPP TECHNICAL INFORMATION. ENGINEERING REPORTS, VOLUME 27, NUMBER 2 [TECHNISCHE MITTEILUNGEN KRUPP. WERKSBERICHTE, BAND 27, HEFT 2]
Jun. 1969 42 p refs In GERMAN; ENGLISH summaries
Avail: CFSTI

CONTENTS:

1. ELECTRO-EROSIVE AND ELECTROCHEMICAL MACHINING PROCESSES A. Winkelmann p 53–68 refs (See N70-12352 02-17)

2. NEW KRUPP AIR CONDITIONING EQUIPMENT H. Ufer and E. Kriegel p 69–76 (See N70-12353 02-14)

3. RETRACTABLE PILOT CABIN FOR INLAND WATERWAY SHIPS U. Lichtenford p 77–78

4. THE KRUPP VISUAL CONTROL SYSTEM: A METHOD FOR MONITORING GRINDING FINENESS T. Diener and A. Supp p 79–86 refs (See N70-12354 02-18)

5. OPTIMUM DESIGN OF TUBE MANIFOLD HEAT EXCHANGERS BY MEANS OF AN ELECTRONIC COMPUTER H. Gelbe, V. Tierling, and H.-P. Paulsen p 87–92 refs (See N70-12355 02-33)

N70-12576# Akademiya Nauk URSR, Kiev.
METHODS FOR COLLECTING AND PROCESSING INFORMATION
1967 185 p refs In RUSSIAN
Avail: CFSTI

Discussions are presented on theoretical aspects of signal generation, analysis of signal transformations, information characteristics for coding systems, accuracy of measuring instruments, and telemetry systems for measuring radioactive, magnetic and other parameters. Methods are also described for improving the effectiveness of the selection and transmission of information. For individual titles see N70-12577 through N70-12596.

N70-12653# Royal Aircraft Establishment, Farnborough (England). Engineering Physics Dept.
INFLATED MOBILE LIFTING STRUCTURES; PRACTICAL DESIGN AND TRIALS OF A CIRCULAR PLANFORM MODEL USING MEMBRANE CONSTRUCTION
A. Y. Simpson 34 p refs Supersedes RAE-TR-68154;
(ARC-CP-1056; RAE-TR-68154) Copyright. Avail: HMSO 8s 6d; BIS $1.70

Early lifting structures had planforms with two straight sides and circular ends and with many lifting points in order to encompass road vehicles economically. Problems of load slinging and structural inflexibility, however, precluded the use of the system for most practical applications. This paper describes tests carried out on a circular planform model to ascertain the effect on performance of only four load attachment points. After several modifications, a practical design was evolved, for use as a basis for a full scale prototype. Appendix B includes a possible application for such a device. Author (ESRO)

N70-12675*# Syracuse Univ., N.Y.
PUBLIC ADMINISTRATION AND SCIENCE AND TECHNOLOGY
W. Henry Lambright Sep. 1969 29 p refs Presented at the Ann. Meeting of the Am. Political Sci. Assoc., New York, 2–6 Sep. 1969
(Grant NGL-33-022-090)
(NASA-CR-106905; Rept-6230-WP-1) Avail: CFSTI CSCL 05B

The history of national science policy is discussed. Budgetary trends in Federal support of basic scientific research in universities and industrial laboratories are illuminated. General proposals are made for establishing an organization to formulate and implement

a Federal science policy, and the necessity of Executive and Congressional cooperation in this endeavor is stressed. R.B.

N70-12682# Krupp (Fried.) G.m.b.H., Essen (West Germany).
KRUPP TECHNICAL INFORMATION. ENGINEERING REPORTS, VOLUME 27, NUMBER 1 [TECHNISCHE MITTEILUNGEN KRUPP. WERKSBERICHTE, BAND 27, HEFT 1]
Feb. 1969 55 p refs In GERMAN; ENGLISH summaries
Avail: CFSTI

CONTENTS:

1. QUALITY CHARACTERISTICS OF TITANIUM PRODUCTION A. Gerhardt p 1–4 (See N70-12683 02-17)
2. PROPERTIES OF TITANIUM AND ITS APPLICATION IN THE CHEMICAL INDUSTRY W. Knorr p 5–18 refs (See N70-12684 02-17)
3. THE INFLUENCE OF PALLADIUM ADMIXTURES ON THE CORROSION RESISTANCE OF TITANIUM W. R. Fischer 19–24 refs (See N70-12685 02-17)
4. PROPERTIES AND APPLICATION OF TITANIUM ALLOYS W. Knorr p 25–38 refs (See N70-12686 02-17)
5. THERMAL POWER STATION AND DISTRICT HEATING SYSTEMS AT THE UNIVERSITY OF MUENSTER R. Ulke and K. Schäfer p 39–46
6. ON THE USE OF A NUMERICALLY CONTROLLED DRAFTING TABLE IN THE COMPUTER CENTER H. Hoppe and R. Stiefken p 47–53 (See N70-12687 02-08)

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